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MANUAL

OF

COST ENGINEERING

AND

ESTIMATING

FOR

PAPER BOX MANUFACTURERS

BY

ROBERT S. DENHAM

WITH

ADDENDA

BY

JOINT COST COMMITTEE

CLEVELAND

ROBERT S. DENHAM

CONSULTING COST ENGINEER

1917

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Preface

Seven years ago the Western Paper Box Manufacturers' Association became aroused to the importance of determining the cost of production in the factories of its members. A Cost Committee was appointed which devoted many days and evenings to a thorough investigation of the various methods of costfinding used by the members, and procurable from accountants and others.

In the final analysis the Committee decided that the Cost Enginering methods offered by Mr. Robert S. Denham were the most practicable for general adoption and use throughout the industry.

At the convention of the Association in January of the following year Mr. Denham gave a practical demonstration of the methods, in connection with the report of the committee, which advised their adoption. The work of the Committee was approved and the installation of Denham Systems recommended.

During several years thereafter a considerable number of paper box manufacturers had the systems installed in their factories. Those who made use of them reported the results as very satisfactory.

The expense of installation, a disinclination to give time and energy to the study of new methods, and a mistaken belief that clerical work was non-productive, therefore unprofitable, led many manufacturers to retain the traditional methods rather than make a change to the new.

About two years ago another Cost Committee of the Western Association made a serious effort to procure a simple formula, which could be adopted and used throughout the industry, without the employment of outside assistance for installation. Their report did not meet with the approval of the Association.

In July, 1916, a Joint Cost Committee, composed of members of the Western Paper Box Manufacturers' Asso-

ciation, the Central Paper Box Manufacturers' Association, and the New England Paper Box Manufacturers' Association, with the president of the National Federation of Paper Box Manufacturers' Associations as chairman, was appointed.

This Committee made an exhaustive study of the systems in use and available up to the present time. Their report, presented at the Western Association Convention at Chicago in January, 1917, is given in a somewhat abbreviated form in the body of this book. It agreed fully with the findings of the first Committee that the Cost Engineering methods employed in the Denham Systems, which have been in practical use for several years in a number of important paper box factories, fully proves up to the ideal sought by the Committee.

After consultation with Mr. Denham, a plan was developed by which it is believed that the paper box industry can be made sufficiently familiar with Cost Engineering methods to use them in making estimates instead of the traditional "material-labor-overhead" formula the Committee so ably shows to be unreliable and inefficient.

This plan was set forth in the resolution presented herewith. This resolution has been passed and approved by formal action by all of the territorial Associations included in the Federation.

WHEREAS, Robert S. Denham, President of the Denham Costfinding Company, Cleveland, Ohio, agrees to prepare copy for, and have printed in suitable quantity a book of the following description:

Approximately 300 pages 6 x 9″; type, 10-point for text and 8-point for notes and descriptive matter in connection with diagrams and illustrations; paper of suitable character and weight; binding, buckram or other substantial stiff binding; contents to comprise (1) a comprehensive and practical Manual of Costfinding for Paper Box Manufacturers, presenting such explanation and examples of the principles and rules for applicattion of the Denham Costfinding methods to paper box factories as will make such application and usage clear to the intelligent student, and (2) in the form of addenda, prepared jointly by Mr. Denham and a Committee appointed by the Paper Box Manufacturers, a schedule of average operation-hour costs of the vari-

ous processes used in the paper box industry, calculated upon and compiled from the experience and confidential cost records of users of Denham Costfinding systems, together with certain valuable tables for use in estimating and calculating the cost of materials. The copy before being placed with the printers shall be submitted to the Committee of Paper Box Manufacturers for their criticism or approval.

The price of the book is to be $10.00 per copy net. Mr. Denham further agrees that at the request of the Committee and under its authority he will arrange and compile from time to time revised schedules of composite or averaged rates for publication by the Box Manufacturers' Committee at an approximate fee of $150.00 per issue. All original information and sources of same to be confidential and unknown to any person outside of the Denham Costfinding Company's organization. Now, therefore be it

Resolved, That in consideration of the labor and expense involved in the preparation and publishing of the above described Manual of Costfinding and addenda thereto, that the Paper Box Manufacturers, through their Committee subscribe for not less than 250 copies of said book, at the price of $10.00 per copy net, and be it further

Resolved, That in consideration of the fact that the Denham Costfinding Company has developed the best known methods of determining the cost of manufacturing paper boxes, that it is regularly engaged in the business of providing competent cost engineering service, for the installation of Cost Systems in factories, and that in placing the results of its large and successful experience at the disposal of the paper box manufacturers in printed form, it assumes certain risks of unfair usage and injurious criticism of methods by reason of inexperienced persons attempting to make installation without sufficient study or knowledge of their problems; we hereby agree, as far as practicable, to protect the legitimate interest of the Denham Costfinding Company by refraining from the employment of any person or persons outside of our regular factory organizations for the service of installing a Cost System modeled upon the methods described in Mr. Denham's book, unless the employment of such person or persons shall be approved by the Denham Costfinding Company, and all paper box manufacturers are advised hereby that it is the sense of this meeting that it will be to their interest and profit, when the installation of the Cost System is decided upon, to engage the services of the experienced engineers who have developed these methods, rather than risk loss of profits through inferior installation by less experienced individuals. Now, again, be it further

Resolved, That the Presidents of the Western Paper Box Manufacturers' Association, the Central Paper Box Manufacturers' Association, and the New England Paper Box Manufacturers' Association, be advised and requested to appoint two members each, one a user and one a non-user of the Denham systems to form in conjunction with the President of the National Federation a Committee of seven to carry out the plan provided in these resolutions.

The manuscript copy of the book was presented at a meeting of the Joint Cost Committee, held at Reading, Pa., July 17, 1917. It received the unanimous approval of the committee.

It is the hope of the Joint Cost Committee, the officers of the National Federation of Paper Box Manufacturers' Associations, and those progressive paper box manufacturers who have proven the practicability of these methods by actual usage, that the industry as a whole will as soon as possible adopt the more practicable methods as set forth herein.

A. G. BURRY,
President National Federation of
Paper Box Manufacturers' Associations.

HENRY L. STORTZ,
Secretary Joint Cost Committee.

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The source of knowledge is experience.

Experience is of two kinds—our own, and that of others.

Knowledge gained from our own experience is most expensive, that gained from others most economical.

Blazing a new trail is rough work, and slow—the beaten pathway is smoother, and swifter, providing it leads to the desired destination.

Life is a great university, from whose curriculum we must choose the course which will best fit us to solve the problems of our day.

Study! Reason! Act!

Stupidity is still the big factor in retarding the progress of the human race.

CHAPTER ONE

Introduction

Objects of This Book—Warning to Reader—Book Not Expected to Make Cost Engineer of Reader—Mistakes of Previous Students of Costfinding—Formulae Not Dependable as Means of Determining Cost—Ratio of Productive to Non-Productive Labor Not Gauge of Efficiency—Examples by H. L. Gantt—Cost Engineering Does Not Discredit Accounting in Its Own Field—Cost Engineering Solves the Problem of Costfinding—Has Passed Experimental Stage—Duties of Man Developing New Idea—Limit of Paper Box Manufacturer's Opportunity for Observation—Distinction of Principles and Rules—How to Study this Book.

The prime object of this book is to help paper box manufacturers make a larger and more certain profit on their business through greater realization of the value of cost knowledge, presenting the means of obtaining such information, and explaining how to make use of it.

Its several purposes may be set forth as follows:

First. To provide a means by which the paper box manufacturer may obtain a clear understanding of the various processes of cost accounting advocated and used in the past, together with the characteristics of each so that he may judge for himself of their merits or weaknesses; thus relieving him of that uncertainty which has characterized the subject.

Second. To present an exposition of the Science of Cost Engineering as applied to the production of paper boxes so that the manufacturer may realize the advantages which it offers for his use, and which caused the Joint Cost Committee of the Paper Box Manufacturers' Associations to advocate the adoption of Cost Engineering throughout the industry as the recognized method of determining cost and in estimating on prospective orders.

Third. To present a practicable and accurate method of estimating the cost of prospective orders of stiff paper boxes, of every description and quantity, based upon the cost and conditions of production under the average of expenses and conditions of individual factories where such a system is in use.

Fourth. To show, for comparative purposes, the average cost of manufacturing paper boxes, under the composite expenses and conditions of a considerable number of factories where Cost Engineering Systems have been in use for periods of one to several years. The latter facts also afford such manufacturers as have not installed Cost Engineering Systems a basis of estimating for their use until such time as they may avail themselves of the opportunity to get the desired information within their own factories.

The author desires to warn the reader that the average costs shown are averages only and not to be considered as showing the cost in the reader's own factory. An average necessarily carries with it the idea that variations exist; a part of the items averaged are higher and others lower; that without actual and active data on his own factory the reader is in danger of selling the product below his own costs, or of placing the price too high and thereby losing business which might be profitably handled if the cost were known. To make this more clear the average is accompanied by high and low costs in the various plants furnishing data.

Fifth. To offer to the paper box manufacturers and their office employees, in the later chapters of the book, in condensed form, some suggestions of advanced business methods gleaned from large experience and extended observation of the causes of failure among the less successful concerns. An effort is also made to correct some erroneous impressions and practices that are prevalent in the trade because of the limited opportunity of its members for observation and by reason of the lack of facilities for making a direct study of modern business methods. The latter is due to the fact that a large proportion of manufacturers have advanced to their present positions directly from the workrooms without special business training.

The author does not claim, nor should the reader expect, that the reading or study of this book will have the

magical effect of making him over into a capable cost engineer.

In fact he rather warns the reader against the too ready assumption that the information contained herein will unassisted enable him to work out his problems of Costfinding.

Bookstores are prolific with treatises upon various subjects labeled in this wise: "How to become a Civil Engineer," "Every Man His Own Lawyer," etc., yet no man ever became a proficient civil engineer or attorney from the study of these books. This fact by no means indicates that the books do not have the effect of broadening the information of the reader, to an extent which made their reading profitable, far beyond the price paid for the book.

There are, and have been for many years, thousands of successful civil engineers and able attorneys. Those professions have been long established, and many schools exist which develop high degrees of proficiency in their students, enabling them to successfully solve the problems which are presented in their experience.

Not so, however, in the field of production costs. Millions of dollars and, in the aggregate, thousands of years have been spent in endeavoring to find the cost of manufacturing the items of commerce.

Unfortunately, those who made the earlier efforts in the direction of determining the cost of production seem neither to have realized the magnitude of the undertaking, nor the importance of the results to those most vitally interested.

Their chief errors, as proved by long and costly experience, were due to the erroneous assumption that formulæ could be created which would serve in all cases as an easy guide to the cost, and for a ready comparison of the relative conditions of the factory in different periods of operation.

The first error was in the assumption that there could be established a formula of Material, direct Labor, and

Expense, which could be relied upon to show the cost of varied items of product.

The second error of importance was the assumption that the relation of certain expenses to each other could be depended upon as a reliable guide to the relative efficiency of the factory organization.

Of the first, much will be said in this book because it deals directly with the chief subject under discussion. Concerning the second, it will be sufficient to quote part of an address by Mr. H. L. Gantt, the noted industrial engineer, before the American Society of Mechanical Engineers (New York), in which he shows several examples of the readiness with which intelligent people will seize upon theories and formulæ which will not bear analysis. Mr. Gantt says:

"With the growth of competition within the last 20 years the necessity for some knowledge of costs became evident, and the manufacturer turned to the accountant for a system of finding costs. The present system of railroad accounting had been developed, and certain ratios accepted as measures of efficiency of operation; notably among them the ratio of operating expense to total income. Being accustomed to having the managerial efficiency of railroads expressed by a simple ratio, the financier demanded a similar simple measure of the efficiency for an industrial plant. The cost accountant promptly gave him what he called the ratio of "non-productive" to "productive" labor, which he said should be low for good management. By "non-productive" labor he meant salaries of all kinds, and all other labor that could not be charged directly to an order, including miscellaneous labor, such as watchmen, sweepers, truckmen, etc. By "productive" labor was meant simply that labor which could be charged directly to an order.

"While the ratio of operating expenses to total income may be a fair measure of efficiency in a transportation company, the ratio of "non-productive" to "productive" labor is not only not a fair measure of the efficiency of operation in a manufacturing plant, but is often exactly the reverse. To my mind the widespread use of this ratio as a measure of efficiency has been more effective in producing inefficiency than any other single factor except the oft-repeated statement that you must have low wages if you would have low costs. Until these two fallacies are abso-

lutely discredited, we cannot expect a solution of our most serious problems.

"Of these two fallacies, the second, namely, that you cannot have high wages and low costs, seems to be yielding gradually to the overwhelming mass of evidence against it. So many cases are now on record where the industrial engineer has increased output, raised wages, and at the same time lowered costs, that only those who are too conservative to investigate are still holding on to the old theory. Better still, many employers have shown the courage of their convictions by adopting a scheme of management for the increase of output and the reduction of costs, which they are perfectly well aware will make a decided increase in wages. With evidence of this kind at hand, it is safe to say that this fallacy will before long be entirely discredited. On the other hand, it must be fully understood that something more than a simple increase in wages is necessary to increase output, and if nothing is done but to increase wages we are sure to get higher costs. The other fallacy, that the ratio of "non-productive" to "productive" labor is a gage of efficiency, is so firmly rooted, however, that it is hardly to be expected that it will yield in the near future.

"In considering this subject I wish to call attention first to the terms "productive" and "non-productive" labor, which seems to me to be misleading. If any expense is "non-productive," namely, does not contribute to the end for which the factory was established, it should be eliminated. The salaries of the officers, foremen, janitors, truckmen and laborers, as well as the money paid for taxes, insurance or interest are necessary to the operation of the factory and therefore productive. They are, however, not chargeable usually to any specific order, but must be distributed over all the work done according to some definite rule. I prefer to call all such expenses that have to be distributed "indirect" expenses, and those that are chargeable to specific orders "direct" expenses. The ratio which we have in mind is thus more correctly described as that of "indirect" to "direct" labor, his, however, is a matter of names and does not affect the fact that to base any conclusions as to the efficiency with which factory is run on this ratio is misleading, and to attempt to use it as the gage in operating a factory may be, and often is, productive of inefficiency rather than efficiency.

"This fact can best be made clear by a series of examples. In a factory where this ratio was used as a guide the following incident occurred:

"A foreman had ten men on a job, which he said could be done by eight if he could have a boy to supply them with work.

He said, however, that if he made the change, the boy's wages would be called "non-productive" labor and his ratio would go up, with the result that he would be criticized, so he did not make it.

"In the U. S. Navy an energetic officer studied the loading of ammunition and very much reduced the direct labor employed, but, being unable to reduce the indirect labor in the same proportion, the above ratio went up. He came in for very severe criticism, notwithstanding the fact that his total labor had been decidedly reduced.

"I might give numerous examples of this kind, including one where two men took the place of sixteen, and a daily direct wage of $8 took the place of $48, with but little increase of the corresponding indirect expense. The result of this and other changes was that the ratio for that shop became over double its former value, with a marked reduction in the total cost. Needless to say, that the ratio theory in that plant is not regarded with the same reverence that it once was.

"Inasmuch, however, as the efficiency of the operation of a factory is made up of the efficiency of a great many independent operations, and is really indicated by the cost of the various articles produced, there has not yet been found any easy way of indicating the efficiency without first getting the cost of the individual article. Hence there is no readily available idol that can be substituted for the discredited one. Having been accustomed to an idol, however, both the accountant and the financier demand one, and are loath to give up the idol they have so long worshipped, no matter how badly shattered it may be. When, however, a reliable cost system has been installed, this idol becomes so badly discredited that even its most devoted high priests are obliged to abandon it."

It is not the intention of the author to discredit the work of the accounting profession in its own field. He believes, however, and the company of those who concur in this belief is steadily growing, that rapid advance in the methods of manufacture has developed a condition which necessitates the separation of the work of cost determination from the domain of accounting, and demands a new branch of engineering which shall cover that particular field. The task is preeminently that of the engineer.

Cost Engineering, around the fundamental principles

of which this book has been written, presents the solution of the problems which have baffled the accounting profession. Cost Engineering has passed the experimental stage, has been developed in over forty different lines of manufacture, and at this writing is in use in over six hundred factories. The Science of Cost Engineering is unquestionably destined to become the universal costfinding method.

It is time the American manufacturer realized that the determination of the cost of production is a serious problem, affecting the vital element of business—profits, and that he should study it as assiduously as the technique of his craft, that he may not only be an artisan but a successful business man as well.

Cost Engineering is a comparatively new science and the author is aware that it must pass through experiences similar to those which have accompanied the introduction of every new philosophy. Many people, bound by habits of thought and the traditions of their craft, are prone to ridicule innovations. Others, mistaking form for essence, can see no merit in it because it does not conform to preconceived theories of their own. Still others, grasping fragments of truth, will be anxious to pose as fully informed, and again unwittingly present new proof of the truth of Pope's immortal line, "A little learning is a dangerous thing."

The man who conceives and develops a new idea, like the creator of a new invention, finds himself facing a double duty to the public. He must not only devote his mental energies to the development of his idea, to the highest degree of efficiency within his power, but recognizing that its value lies solely in its use, he must patiently and persistently persuade others that it is worthy of their adoption and support.

He must oppose ignorance, mental apathy, habits of thought and the opposition and misrepresentations of those interested in similar but inferior projects. But the

man with a real message for men will not fear criticism or skepticism. Those who have contributed most to the world's advancement have been the most conspicuous targets for the tirades of the ignorant and unbelieving. Truth will prevail in the end. The greatest error possible, to the man who knows, is the act of giving up his work in fear of criticism. Great minds find it profitable to seek knowledge from humble sources. It is only little minds that scoff at earnest effort, criticising the worker. Even a wobbly-legged pup can bark at the heels of a Lincoln.

The author recognizes that there are many brilliant and capable minds in the paper box industry. Most of them, however, have been limited in their opportunities for observation and for comparative study because their effort has been necessarily within the precincts of relatively few business concerns. He therefore hopes that all will find within these pages either new ideas or new viewpoints of old ideas which will make their reading profitable.

Keep in mind the thought that mere opinions are worth little, that no opinion concerning a problem should be accepted while resort may be had to fundamental principles as a means of proof.

The reader should differentiate between principles and rules. Principles are fundamental truths, eternal and unchangeable. Rules are man-made and subject to change.

Men may express principles by formula to create a working hypothesis. But if a single fact of experience develops proof contrary to the formula, the hypothesis fails and must be corrected or abandoned.

There can be no exceptions to principles. Rules, on the contrary, are created as temporary tools. They serve their purpose and are changed or discarded with the progress of knowledge. Exceptions to rules may be frequent without destroying them.

Study this book with a broad mind, not with intent to judge its merit by standards of your past experience, but rather to get the viewpoint of the author so that his work may be judged in relation to provable facts.

The greatest present need is an antidote for the unwillingness of men to profit by the previous experience of others. It would be amusing, were it not so expensive, to watch the gropings of many corporation officers for methods to test efficiency. Ignorant of fundamental principles, intolerant of outside suggestion, unable to detect the analogy in other undertakings, they repeat the expensive experiments of the past.—*Charles DeLano Hine.*

CHAPTER TWO

What is Cost?

Definition of Cost—Definiteness of Expense Factors—Purpose of Cost System—When Cost has Been Determined—Factory Compared to Department Store—The "Fair Deal" as the Basis of Business—Hurley on Unfair Competition—Common Misconceptions of Cost System—What does Not Constitute a Cost System—Omission of Expenses by Majority of Manufacturers—Material Items in Manufacture of Paper Boxes—Expenses of Selling, Making and Delivering—How Expenses Must be Charged—True Cost Source of Profit, also Satisfaction to Both Manufacturer and Patron—Clerical Work Required by Cost System—Degree of Accuracy Desirable—Practicability a Prime Factor—Success of Installation Dependent upon Skill of Engineer—Cause of Present Deplorable Conditions of Competition.

The cost of an item of product is the sum of all expenses incurred in its production. Nothing can be more fundamental than the truth contained in the foregoing statement.

Every expense item is definite. It must be definite in amount or it could not be recorded. It must be definite in purpose or it would not be authorized.

It follows that if every expenditure is definite, and cost is the sum of certain definite expense factors, cost must be a definite amount. The term "sum" implies definiteness.

The purpose of a cost system is to determine what is that definite amount which represents the total, or sum, of expenditures. It follows also that since the cost of each item of product is a definite amount, two systems that arrive at different results cannot both be right. One may be right, another wrong, or both may be wrong, but it is impossible that both can be right.

To this statement some will say, "That depends on how you figure it." To these we must answer, "Cost is a fact. When an article has been completed, no opinion, or method of figuring, can change the amount of its cost. Opinions can have no influence upon facts." Cost systems have as their prime object to determine the exact

sum of the elemental expenses involved in producing the item under consideration.

We get clearer thoughts and ideas if we agree upon definitions of terms. Let us then establish this basis of understanding: *Expenses are the elements of cost. Cost is the exact sum of the elements or expenses incurred on account of the item under consideration, up to the time, or point, at which cost is determined.* Cost has not been determined unless every cent of expense has been included, nor if the result includes a cent of expense rightfully chargeable to some other item.

One of the most practical methods of getting the proper viewpoint is to consider the factory divisions as departments in a department store.

The factory order is made up of widely varying amounts of material and time items, each of which has its individual cost per unit, just as the store customer's orders vary in items and prices.

The merchant who would furnish goods to one customer, charging part of the cost to another, would soon find himself in serious trouble with his patrons. But such action would be identical in principle with that of the manufacturer who charges one part of his product with expenses properly chargeable to another, passing the charges on to the customers.

The fact that the manufacturer's customer could not so readily check up the items has generally made the offender immune from the customers' ire, but recently the consumers have begun demanding fair play from the manufacturer. Keener competition and more intelligent buying have made better methods of costfinding imperative.

The "fair deal" is coming to be more and more the basis of business. In his recent book, "The Awakening of Business," Edward N. Hurley, Chairman of the Federal Trade Commission, says: "Every article produced should bear its equitable share of all expenses, including overhead and selling expenses. There are manufacturers

whose line consists of, say, six articles; on three they are making a profit and on three they are losing money, but claim that these three articles help to take care of the overhead expense. This method of doing business is most detrimental to healthy business conditions. Frequently one of these articles may be the sole product of an individual who is striving and struggling to exist against a firm which is placing the same article on the market as a means to help take care of its overhead expense. Surely this is not wholesome competition. An adequate cost system would reveal this unhealthy condition and make a remedy possible."

The cause of most of the unfair competition is unquestionably the prevalence of erroneous ideas as to what constitutes the cost. A hundred men chosen by lot from the paper box industry might be called upon to furnish in writing a statement of what they would consider the proper elements of expense, and the proper methods of charging them to the product, and no two would agree either in the items or methods of application. When such a condition exists, and it unquestionably does exist at this writing, it is high time that someone with experience undertook to unify the methods of calculation for the craft.

It would be impossible as well as tiresome to enumerate the peculiar conceptions of cost and of costfinding methods which prevail among manufacturers, many of whom have been engaged in business for several decades. The following examples will serve to illustrate some of the more common errors:

(a) *"I figure the cost of materials, and add the wages of the workmen for the time they spend on the order, that gives me the actual cost. Then I add one hundred per cent for overhead and profit."*

It is difficult to understand how any man with reasonable intelligence can offer such a formula seriously. Materials and wages do not in any sense represent "actual cost." They comprise but two important items in a long

list of expenses, none of which have any relation to the amount of materials or wages involved in the production of the product. At best this plan can be considered an estimating or price-making system of very doubtful value. The addition of a single percentage to cover both a part of the expenses and the profit serves to conceal rather than to show the cost. This is sometimes done in a purely merchandising business, but under certain conditions only, as will be explained in the chapter on "Figuring Percentages and Profits."

(b) *"I used to figure a percentage of overhead on material but found that it was wrong. Now I put my overhead on the direct wages only, and add the cost of the material to the total, then add another percentage for profit."*

This manufacturer discovered that operating expenses did not increase with increased cost of materials, nor decrease when cheaper material was used, so he abandoned the percentage of overhead on materials. Had he taken a second thought he would have discovered also that the operating expenses were equally independent of the wage element. Had he gone far enough in pursuit of the truth he would have proven to himself that every expense is definite in amount, object and benefit; and that in the entire category there is no instance where two expenses having different objects can be depended upon as being chargeable in the same proportion. It follows therefore that there is no single expense or group of expenses which can logically be used as a basis for the application or distribution of another expense or group of expenses.

(c) *"I am using a cost system which I established about ten years ago. I kept track of my expenses for one hundred days and averaged them to get my daily expense. I add this to my payroll to get my cost."*

This is one of the examples that proves how little some manufacturers use their mentality. There was nothing in this case to show that this manufacturer really

had ever made use of this "system," nor could he explain clearly the process by which he applied his average daily expense to his payroll. The author concluded that this story was a "habit" which had served him to "get by" so often in the past that he had developed nerve enough to try it even on a cost engineer.

Such a plan, even though the records were recent, instead of ten years old, is ridiculous. It is amusing, were it not so serious, to consider the curiosities which men, who otherwise seem sane and capable, bring out for exhibition as "cost systems."

No scheme of figures can be entitled to recognition as a cost system unless it actually does, with a reasonable degree of accuracy, determine the amount of the various expenses involved in the production of a given item of product.

It is absolutely certain that no plan which bunches together a mass of expenses for simultaneous distribution, such as is common in overhead or general expense accounts, can be relied upon as a cost system. Such plans destroy the identity of expenses and the records of the purpose of each; both must be known if intelligent distribution is to be accomplished.

In casting up their expense items for the purpose of creating bases of calculation, few manufacturers include more than half of the items in number, and seldom more than 85 per cent in amount. The larger proportion in amount is due to the consideration first of the more important items, such as labor, rent, selling expense, etc.

The following lists are fairly complete, although each individual factory will have some items peculiar to itself:

LIST OF ITEMS OF MATERIALS USED IN MANUFACTURE OF STIFF PAPER BOXES

Bottoms
Box Covers
Cases
Cloth
Edges
Flies
Flowers
Glue
Hinges
Labels
Lace Paper
Lid Covers
Lining
Metal Edges
Neck Covers
Packing Paper
Padding
Paste
Printing
Pulls
Ribbon
Seals
Setting-up Material
Stay Paper
Tapes
Tops
Trim
Twine
Wire for Stitchers
Wood

EXPENSES OF SELLING, MAKING AND DELIVERING STIFF PAPER BOXES

Advertising
Advertising Postage
Automobile Expense
Bad Accounts
Belting
Belt Lacing
Bookkeeping
Costkeeping
Clerical Help
Depreciation on Building
Depreciation on Equipment
Depreciation on Merchandise
Discounts to Customers
Deductions for Errors, etc.
Donations
Dues, Business Organizations
Drivers' Wages
Electric Current for Lighting
Electric Current for Power
Errand Boys
Express Charges
Foreladies' Wages
Foremen's Wages
Freight
Fuel
Gas for Lights
Gas for Heat
Helpers' Wages
Inventory Clerk
Insurance on Buildings
Insurance on Equipment
Insurance on Raw Stock
Insurance on Work in Process
Insurance on Finished Stock
Insurance, Liability
Insurance, Boiler
Interest on Real Estate Investment.
Interest on Building Investment
Interest on Equipment Investment
Interest on Raw Stock
Interest on Work in Process
Interest on Finished Stocks
Interest on Accounts Receivable
Lubricating Oil
Manager's Salary
Other Officers' Salaries
Officers' Traveling Expenses
Postage—Commercial
Porters' Wages
Rent
Repairs to Building
Repairs to Equipment
Salesmen's Salaries
Salesmen's Commissions
Salesmen's Traveling Expenses
Signs
Soap
Spoiled Work
Superintendent's Salary
Stenographers
Stockkeeper's Wages
Storage
Supplies for Factory Operations
Supplies for Factory Office
Supplies for Commercial Office
Supplies for Sales Office
Telephones, City
Telephones, Interior
Telephones, Long Distance Messages
Telegrams
Taxes, Income
Taxes, Corporation
Taxes, Realty
Taxes, Personal Property
Towels
Waste, Cotton
Waste Paper Baling
Watchman
Watchman's Clock Supplies
Water Rent
Workmen's Wages

Every order for paper boxes requires more or less of the items of materials enumerated in the first list. A simple box will require a few only, while a fancy box may require nearly all of the items.

The expenses due to commercial and factory activities, however, are so interwoven between the various kinds of effort that practically every one of the items enters to a greater or less degree into every order.

All items of expense must be charged in such a manner that every customer shall pay his just proportion of each, no more and no less.

It is not surprising that in the absence of any definite method of analyzing processes and expenses the estimates of cost should differ so greatly. Manufacturers who realize the difficulty of arriving at true cost, often put on large percentages to cover overhead, in the belief that it pays to "get on enough." The fact is that this plan is almost as bad as making the price too low. When the price is too high it not only drives away business but creates the impression that the successful competitor, who provides good product at a lower price, is a more efficient and economical producer.

A knowledge of true cost, determined through a practical system, not only proves a source of satisfaction and profit to the manufacturer using it, but serves as a means of creating confidence in him on the part of the customer that his prices are fair.

In considering the advisability of installing a practical cost system, one of the first thoughts on the part of the manufacturer is that the amount of clerical work must be greatly increased.

If the system is properly planned the amount of clerical effort should be no greater than with the plan in common use wherein the amount of direct wages at time rates, is compiled as a basis for applying the overhead.

The question next arises as to the degree of accuracy which should be demanded. Laxity is dangerous in that

it tends to create loss of profits in one direction, and the loss of business in the other. Exactness also may be carried to a point where expense of clerical effort and demands upon the human factor make it impractical.

Practicability becomes the prime factor, therefore, in the choice of a cost system. Practicability will not admit of inaccuracies great enough to cause loss of profits, neither will it permit such minutiæ of detail as consume the profits or tax the mental energy in elaborate calculations.

Planning a system which will require the minimum of entries and special skill in operation, without deviating from true accuracy enough to affect the selling price, is the ideal which should be attained. If the variation from true cost does not affect the selling price, it is obvious that it cannot affect the profits.

The success of the system depends, therefore, to a very great extent upon the skill of the individual who plans it and teaches its operation. He must know how to concentrate on essentials, and how to eliminate non-essentials. The novice in the science of Cost Engineering is not more likely to succeed than the novice in the science of chemistry.

Cost Engineering is in its infancy, compared to chemistry, yet the average man seems quite sure that he could design and install an accurate cost system at the first attempt. Because his effort is not immediately followed by the "explosion" of bankruptcy, he assumes that he has succeeded where thousands of men before him have failed. He does not realize that a concern can lose ten per cent of its capital every year and yet stay in business for fifteen years, which is a longer period than the life of the average business.

The absence of logical and definite methods in the past is responsible for the deplorable condition in which the producing industries find themselves as they are gradually aroused to economic consciousness. Even the accounting profession has failed to grasp the fact that

mechanical progress in production methods has outdistanced its traditional fallacies of "material, direct labor and overhead" as certainly as the motor car has outdistanced the ox cart. Moreover, the ox cart did eventually reach its destination, while the cost accounting formula cannot possibly succeed under conditions common in factories today.

In the final analysis we find that the cost of an item of product is the sum of the elemental expenses involved in its production; the cost of an item either in the warehouse, or sold, is the sum of the expense elements incurred for its benefit in production, handling and marketing, up to the time at which cost is determined.

CHAPTER THREE

Advantages of Knowing Cost of Production

The Buyer's Query—Universal Desire for Reward—Ways of Increasing Profits—Delusion of Wages as Cost Basis Responsible for Serious Losses—Dangers of Percentage Greater in Complex than in Simple Factories—Causes of Unfair Competition—Small Orders Though Desirable Need Careful Attention to Prevent Loss —Financing the Experiments of Others—Cost Records as Foundation for Estimating—Analysis of Expenses Provided in Cost Summary—Comparison of Records to Determine Causes of Fluctuations in Cost—Comparison of Expenses with Charges—User of Rule-of-Thumb Outdistanced by Man Who Knows—Profitableness of Intelligently Directed Effort—Meeting the "Shrewd" Buyer—Money Necessary But Not Object of Life—Happiness the Great "Desire"—Summary of Advantages.

The normal thought in the mind of the person who is asked to buy something is, "What is there in it for me?" This is doubly true of the man who is not only asked to buy service, but also to study a new science so assiduously that he will change his habits of thought in connection with the everyday routine of his business.

All human activities, whether business or philanthropic, have as their object a "reward." The reward of business is Profit. The philanthropist takes his reward in mental satisfaction with himself for having helped others along life's rugged way. This chapter has to do primarily with the object of business—Profits.

Profits generally are reckoned in terms of finance, at least the world judges of a man's success by his ability to increase the amount of his net assets through profitable business transactions. There is, however, an important element of personal profit in self respect if the transactions which yield the increased assets are untainted by unfairness either to one's customers or competitors.

As a means of conducting a financially profitable business the Cost Engineering system offers large possibilities.

The manufacturer is accustomed to assuming that there are only two ways of increasing his profits—higher

prices and larger volume. The fact is that these are the more difficult methods by which the result is accomplished. They present themselves first because of the theory that a big business offers opportunity for profits in proportion to volume, and the obvious fact that the cost of an item being the same a higher price will yield a larger profit.

Under a careful analysis it is usually found that the expense of driving for more volume, and the usual lowering of prices to this end, destroys the profit on the new business. If the price is lowered to get the customer started he will expect the price to be correspondingly low on future orders. This makes it difficult to get the new business on a permanent and profitable basis.

A raise in prices is likely to curtail the business to a certain extent, especially if there is a uniform raise, because under the ordinary conditions some items of product are already rated too high, and others too low. Those which are too low will stand the raise, but those which are too high will not.

The old idea of assuming that cost is related to direct wages frequently leads the manufacturer to believe that the most profitable items are unprofitable, and vice versa. Several instances have come directly under the observation of the author where the manufacturer was considering the discontinuance of the most profitable part of the business under the impression that it was unprofitable.

This is likely to be the case in a combination stiff and folding box factory. Many stiff box factories have very little machine equipment, especially if the boxes are of a fancy grade involving a large use of partitions, trays and trimming. If this type of factory is operated in connection with a folding box factory where the product is made largely with printing presses, cutters and creasers and automatic gluers, all rapid machine processes, the overhead will mainly be placed on the hand work, although the investment, power and supply elements are much greater in the folding box divisions than in those of the

stiff box. The result is that folding boxes seem to be produced much more cheaply than is actually the case and are apparently much more profitable. Under these conditions the folding box division becomes an unfair competitor of the exclusive folding box manufacturer, although its owner is thoroughly conscientious and believes he is fair.

The majority of cases of unfair competition can be traced to just such causes. The only remedy is the general introduction of scientific Cost Engineering methods.

With a system which makes it possible to know positively what it costs to produce each of the hundreds or thousands of orders which pass through a factory in a year, and to know the hourly cost and output of the processes, it is possible in a comparatively short time to determine the losing orders. The live manufacturer will then tactfully convince the customer of the necessity for raising the price. But it will not be necessary to change the price on the profitable business. This can be retained at previous prices, and more business of the same kind developed.

Small orders are frequently the most prolific sources of trouble and loss, yet the small order should not be looked upon as undesirable. With correct analytical costs it is easy to determine what is a fair price for any given piece of work and to demand it. Experience proves that the production possible with a crew of operators in a day on small orders is but a fraction of what the same crew can produce if the runs are long and uniform. It is impossible, with wages as a basis, to determine fair prices for this work.

The customer who needs a few boxes has no right to demand that the box manufacturer not only provide him with the boxes which he needs, but present him as well with a part of what is truly a part of their cost.

The buyer experimenting with a new commodity, and who does not wish to risk a large investment in boxes, should not expect the box manufacturer to help in financ-

ing his scheme and to protect him against the possibility of loss by furnishing him with a few boxes at the quantity price. If his scheme has not sufficient merit to warrant his assuming all of the burden of risk, it is probably not worth developing. He should be satisfied that the box manufacturer is willing to take on the small order at any price.

The records compiled in connection with a practical cost system serve as a foundation for practical estimating, while the records of production following the securing of the order on which an estimate was made, serve as an absolute check on its accuracy. The continuous alternating of estimate and cost, estimate and cost, again and again, provides for the wide-awake estimator the most excellent training and checking. Such experience is bound to develop a skill in estimating which will eliminate a large percentage of the leaks due to that phase of the business.

The analysis of expenses afforded by the periodical cost summary proves a valuable means of making comparisons from month to month so that waste in expenditures may be eliminated. From this tabulated statement the manufacturer not only learns the cost of the various processes, but can compare the elemental expenses, item for item with previous like periods, to determine the causes of cost fluctuations.

The same analysis shows the conditions of activity or inactivity in the various processing divisions of the factory. The comparison of productiveness with expenses shows in dollars not only the elemental and total expenses of each processing division but, for the like purpose of comparison, the amount charged against factory orders for the same period.

With this information in hand the manufacturer is in a position to meet the necessities of abnormal conditions as they arise.

Prosperous times alternate with "hard times" as certainly as day with night. The well-informed manufac-

turer is in a position to note the trend of conditions and, figuratively, trim his sails to meet the industrial storm in time to save himself from large losses. He has the means at hand to show him how to readjust his prices to the unusual conditions so that his business may be profitable even through times that are generally the reverse of prosperous.

The manufacturer who follows the "rule-of-thumb" methods of conducting his business, or places his confidence in a system which assumes that a part of his expenses can be used as a basis for the application of other expenses, is certain to be misled in periods of depression or readjustment. He may succeed in the prosperous time by being carried along on the wave of a strong demand. But he is bound to be outdistanced in the long run by the man who has the details of his business in such shape that he is informed of every serious condition in ample time to make due preparation to meet it.

Intelligently directed effort can always be relied upon to yield a larger return both financially and mentally than any hit or miss effort.

From the purely financial standpoint there are many other advantages to be had from knowing the cost of the product. Not the least of these benefits is the ability to deal with that type of shrewd buyer who assumes to know all about the paper box business. He can, to his own satisfaction at least, figure the cost of the boxes he wishes better than you yourself.

He is smooth-tongued. Unless you are careful he will convince you that he has had a large experience and that after all you are only a novice in the business. He talks glibly of direct labor and the application of overhead expenses, minimizing the larger items of expense and omitting a considerable portion of the lesser, then tries to show you that since you have to maintain your plant and pay your rent anyhow, the only extra expense you will have on his account will be the material and labor. Therefore you can afford to take his order at a very low price.

The added advantages of a larger volume will be all yours (and the gain all his).

In addition to that cost knowledge which is fundamental in a manufacturing business, you will be able to put into operation, if you care to do so, a system of standards and records which will have the effect of greatly increasing the efficiency of your workmen.

The possibilities that unfold before the paper box manufacturer in the contemplation of his subject are enormous and far-reaching in the opportunities for development, both for increased production at a smaller expenditure of energy and for larger financial profit.

After all we live in our emotions or feelings. Money is only a means to an end. It is very necessary in the scheme of life, but getting money must not be the only object. Too many of us live as though money was the one and only desirable objective.

Our happiness, and that of those we love, constitutes the Great Desire. If money will help in the attainment of that end it is desirable. But a clear conscience and a sense of fair dealing with our fellows are equally important.

The thief may get money but he cannot be said to enjoy it. He simply mistakes the means for the end and after committing crime, lives a life of fear and shame. The man who takes unfair advantage of his customers in business transactions may get money quickly, and still be within the law, but he cannot enjoy the same peace of mind, or satisfaction in life, that is the lot of the man who deals fairly.

In the beginning of this chapter the author stated that "all human activities have as their object a 'reward.'" Profit is the reward of business. Happiness is the reward of dealing fairly and justly with our fellows.

The advantages of knowing the cost of production may be summed up as follows:

The certainty of a better living for yourself and

family than could be expected under conditions where part of your product is sold at a loss.

A larger measure of respect from your customers. No matter how much people may like a bargain in price when they are buying, they respect the successful business man and prefer to deal with him rather than with his less successful competitor.

Greater confidence on the part of your bank. The business of the successful man is solicited by the banker. The man who operates his business in an uncertain manner must beg for banking favors, if he gets them at all.

Greater admiration and larger cooperation on the part of your associates. Financial success attracts desirable people to a business. Fair dealing cements their friendship so that the successful and fair dealing manager can have the unquestioning cooperation of his associates in any undertaking by merely indicating his desire.

Unlimited credit. Credit is not determined so much by the financial statement rendered as by the character of the individual who controls the policies of the business. The man with a record of knowing his business so well that he makes a fair margin on every sale, and takes his discounts regularly, can be trusted not to overbuy. A jobber will give him unlimited credit though he will cautiously watch the larger concern which conducts its business in a less certain manner.

Best of all you will be able to command in a larger measure your own self respect. The man who sees the years go by without reasonable gain; who must answer every vital question in his business with "I don't know," or realize that in trying to fool others into the belief that he does know is fooling only himself; such a man certainly can neither respect himself highly nor command the respect of others.

"The ability to succeed is inherent in every man. It differs only in degree. There is opportunity for every man to give the best that is in him. Perseverance is the key-note of success. The man lacking it or permitting it to lie dormant can never hope to rise above mediocrity."—*Theodore P. Shonts.*

CHAPTER FOUR

Necessity for Advanced Methods

When Accuracy Was Unimportant—Origin of Cost Accounting—Demand for Definite Figures—The Makeshift Percentage Formulae—The Change from Simple to Complex Methods of Manufacture—Changes in Cost Accounting Formulae—Introduction of Labor Saving Machine Tools—Effect on Costs—Failure of Percentage Formulae to Meet the New Conditions—The Demand for Individuality in Product Cause of Great Diversity—Rapid Development of Machines Creates Grave Problems—The Three Essentials of Modern Cost Systems.

There was a time in the history of American industries when exact information about cost of production was of very little importance. That day has long since passed and will never return.

In the early days, there were no machine tools, no railroads, no traveling salesmen, and practically no competition. The manufacturer, if such the neighborhood cooper, blacksmith, cobbler, or weaver might be called, had but to provide the shelter, the benches, and the materials, to start a factory.

Then the workmen usually owned the inexpensive tools of their trade. Human nature was the same then as now. Some workmen took pride in keeping their tools sharp and in good order, while others did not. A careful workman did not like the careless one to have the right to exchange tools at will.

As there were no railways or steamships, transportation was limited to the capacity and speed of horses and sailing vessels. There was little opportunity for more than a local business. Foreign commerce consisted almost exclusively of staple products, largely raw materials, as wool, cotton, tea, coffee, tobacco, etc., or such manufactured products as became the raw product of other factories, as cloth, leather, etc.

Buyers went abroad and bought these articles, bringing them home for sale to the users. They paid for them whatever prices they could get the sellers to make. Those

were the days when the demand exceeded the supply, when production methods were crude, laborious and slow. Overstocking was rare. There were neither traveling salesmen nor bargain counter rushes.

If a man wanted a manufactured article he went to the local artisan. If none were near, he bought the raw materials and did the making, more or less crudely, himself. If he bought it, he paid such price as he could get by sharp bargaining.

The maker needed but a simple price-making system. He took the cost of material, the wages of the workmen during the time required to make the article, and added as much as he thought he could get. The one-price system had not arrived. He aimed to allow a margin wide enough to cover his expenses, a fair profit, and leave something to take off, so that the customer would think that he was getting a bargain.

As the population increased, and transportation facilities developed his market enlarged. He made his products in greater quantities and sold them too in larger lots, to others, for resale to the consumer. Ease of transportation made it possible for the middleman to get prices on what he wanted from several makers. Price lists were developed. This again created a demand for more definite knowledge of cost that the margin might be narrowed to meet competition without losing the fair amount of profit demanded by good business.

Now the manufacturer, or his accountant, found that the measurable items were labor or wages, and the cost of material. The exact amount of other elements, being more or less indefinite in the individual articles, could be known positively only in the gross amount. The total of the expenses for the measurable items and the total for items deemed unmeasurable were compared, the percentage of the latter to the former determined and the theory evolved that if the expenses of wages and material were calculated and this percentage of the so-called "overhead" added, the result would prove to be the cost. If the goods

were sold at a price greater than the amount thus determined, the margin above the total of the three items would be net gain.

This proved a very practical method as long as the conditions, under which it had been evolved, were maintained. Some factories are still able to prosper under this method of price-making. Nevertheless the great majority of failures for several decades have been directly traceable to following this method under conditions very different from those under which it was evolved.

Gradually the manufacturers whose product could be made up with different grades of material or who broadened their business so that their product consisted of several distinct lines, found that an increase in the price or value of the material did not proportionately increase the amount of operating expenses. Neither was there a perceptible decrease in operating expense when cheaper material was used. These manufacturers changed the formula to omit the overhead element in connection with material; endeavoring to determine cost by adding a percentage to represent overhead to the wages for time directly applied on the factory order and adding the cost of the material to the total. The chief cause of loss, however, where percentages of overhead were applied under either formula, has been one which was intended, and when properly considered, proves to be a very potent factor in saving expense, and a prolific source of increased profits—the labor-saving tool or machine.

Few manufacturers realize the effect of introducing a machine to perform an operation previously done by hand. They become so accustomed to considering that wages are an indication of the cost of factory operations that they fail to recognize that the machine which performs the work formerly accomplished by five people, and with an outlay for wages of one person, decreasing the wage element eighty per cent, also introduces many other elements of expense that did not exist, or were inconsiderable, in the hand method.

The product of most modern factories is intensely diversified, yet each item results from the application to selected material of varying amounts of the time of several processes. Some of these are performed by more or less mechanical equipment; others are still accomplished by handworkers of varying degrees of skill. Cost-finding under modern conditions may thus be considered a highly complicated subject.

The primitive manufacturer had to contend with few complications. His product was simple. He had but a small investment in equipment, no expense for power, repairs, supplies, and the multitude of other necessities created by modern processes of production.

A modern manufacturer is faced with the demand for an individuality in the product required by nearly every customer. Even though he makes only paper boxes, his product is likely to be elaborately diversified. The inventive genius of the indefatigable Yankee has developed machinery for many processes. Single machine units in some instances require an investment of thousands of dollars. Some machinery can be used almost constantly during the entire working period of each day. Other machines, because the demand for their special processes is less, may stand idle the greater part of the time. Power must be provided. Replacement or depreciation considered. The large investment demands a charge for interest. City, State and Federal Government demand taxes. Repairs must be made, and supplies furnished.

Every process performed by machines involves a different amount of investment. Depreciation must be calculated at different rates; motors are of various sizes and are run for varying amounts of time. The amount of repairs differs, as does also the amount and kind of supplies. Some processes require large areas of floor-space, others small. Some require highly paid skilled workers to get efficient results, others can be set and started by a skilled mechanic, and attended to by unskilled persons at low wages.

Throughout the processes included in the modern factory there is practically no uniformity in the items of expense; nor in the time or conditions of operation. How, then, can there be any uniform proportion of wages and of the items which commonly comprise the overhead expense account?

The answer is clear. No such uniformity exists. Nor can such a theory or formula as has been described be relied upon to show even approximately the cost of making any item of product, to say nothing of an ever-varying series of special items which may be required to meet the individual ideas of consumers.

Three essentials are paramount in considering methods of determining cost. Named in the order of their importance they are: Accuracy of result; Uniformity of application under like conditions; and Adaptability to all the variations existing in factories at present, or which may in future be developed.

Accuracy is first, yet there are many manufacturers who do not realize its importance, and who ask. "What's the use of splitting hairs?" They seem to think that if they get within five or ten per cent of a correct result, that is near enough. They have no means of knowing whether or not they are accurately within five or ten per cent, and if they were that amount may represent the total of the profits on the transaction.

The average manufacurer in considering elements of expense or variations from correctness is apt to consider these items in their relation to the total amount of the order or the volume of business. They do not realize that taking ten per cent as a fair net profit on the volume of sales, a variation downward of two per cent on the order because of inaccuracy means a loss of twenty per cent of the profit, the vital element of gain for which he assumes the work and cares of business. Half of one per cent means a loss of five per cent of the profits.

A variation of a tenth of a cent in determining the ratio of distribution of an elemental item may through the

multiplication of the item involved create an inaccuracy so great as to destroy all profit on the output of a process. On the other hand, the variation being in the form of an overcharge, the tendency will be to drive away business which could be profitably handled if true costs were known.

Accuracy is unquestionably of prime importance in any plan of cost determination, yet the novice is very liable to confuse essentials with non-essentials. Accuracy in a rate is very much more important than accuracy in a result. A variation of one-half cent in a unit-rate makes a difference of five dollars in the apparent cost of a thousand units, while a variation of ten cents in the total can affect the profits only to the extent of ten cents.

This explains the reason why the cost engineer sometimes insists upon rates expressed in hundredths of cents, and at other times drops fractions entirely. The effect upon the final result is the deciding influence.

Uniformity in the treatment of processes or in data where conditions are relatively the same is very essential, particularly where competitive conditions exist. Co-operation is the key note of the new competition. If manufacturers are to cooperate they should speak the same technical language and handle their problems in practically the same way.

Under the old formulæ of cost accounting, if one manufacturer applied the overhead to labor alone, adding the material to the total, while another applied his overhead expenses to both wages and material, a source of much trouble and misunderstanding developed. Many unthinking men have asked "What's the difference, provided all of the expense is applied against all of the product?" The difference is very great.

Suppose two customers are seeking prices on boxes for their respective requirements. One wishes ten thousand large skeleton boxes, the other needs ten thousand small covered boxes. The skeleton boxes involve a large

amount of board with but little processing. The small boxes require far less material but much more effort in the making.

The manufacturer who puts his overhead on both wages and material makes a high price on his skeleton boxes and a low price on the small boxes which involve less material. The manufacturer who applies the overhead on labor alone will make a low price on the skeleton boxes and a relatively high price on the small boxes where the labor element is large.

Each is making prices conscientiously according to his belief in connection with cost accounting. Each looks upon the other as a price cutter, because the only information they have about each other's prices is in connection with the job that was lost. The wide variation in quotations seems to prove, according to the competitor's method of figuring, that the man who took the order for the skeleton boxes made a price at about the cost of the material.

But the greater misfortune in such methods remains to be explained. The manufacturer who applies the overhead on both material and direct labor continually drives away orders in which materials are a large factor. Thus the proportion is constantly changing with the result that his output does not actually carry the full burden of overhead. His profits dwindle or disappear altogether. The one who puts it on labor alone drives away the business in which labor is the chief element with a like result.

Under Cost Engineering described in succeeding chapters of this book, such discrepancies are entirely eliminated. Material is charged only with the expenses incurred on account of material; each individual process is assessed with only the expenses involved in its operation and correct unit rates established which make overcharges and undercharges impossible. Prices based upon these methods are absolutely just to manufacturer, customer, and competitor. They not only eliminate losses,

but make for progress in the industry because of a better understanding and greater confidence between paper box manufacturers.

Adaptability to varying and variable conditions, placed third in the group of essentials, is hardly less important than either of the others.

Paper box factories differ from each other so greatly that no two of them may be said to be alike. Methods whose accuracy would be affected by adoption in different factories would be failures, or methods affected seriously by changes within the factory where established would be impracticable.

Stiff box factories range in size from small concerns, employing three or four people, up to large concerns employing hundreds. Stiff box factories are operated frequently in combination with and under the same management as other lines, such as folding boxes, envelopes, novelties, shoes, printing, die stamping, cigar boxes, shipping cases, etc.

Methods to be practicable must permit of every possible variation in the product, every possible combination with other lines, and must not be adversely affected by the addition or discontinuance of other lines, without regard to beginning or end of the fiscal year or other period at which records may be closed.

Under the requirements demanded by modern business conditions, the old methods of cost accounting must give way to the more advanced methods which have been developed through the science of Cost Engineering.

CHAPTER FIVE

Comparison of Cost Accounting and Cost Engineering

Principles of Cost Engineering Unknown to Cost Accountants—Reliance upon Formulae Taught in Cost Accounting Literature—Investigation of Methods and Report of Joint Cost Committee—Purpose of Records—Requirements of Ideal System—Remarkable Diversity of Methods Used in Representative Plants—Necessity of Correct Distribution of Expense—Methods of Cost Accounting—Percentage on Material—On Labor—On Prime Cost—On Man Hours—On Unit of Product—Inadequacy of Foregoing Methods—Examples of Paper Box Cost Calculations, by H. L. Stortz—Cost of Shipping and Delivering—Table and Chart Showing Lack of Relation Between Wages and Other Expenses—Statement of Cost Engineering—Suggestions to Student of Cost Engineering.

In the preceding chapters references, more or less critical, have been made to methods which were termed "cost accounting."

This term is used to designate the methods employed by the accounting profession up to this time, and sanctioned, nay advocated, by the authors of a considerable list of books written by professional accountants, most of which include in their titles the term "cost accounting," and all refer to the procedure described by the same title.

Throughout the literature of cost accounting the only principles recognized are the principles of accountancy relating to the records of transactions, viz: "For every debit there must be a corresponding credit," and the correlative requisite that "The sum of the debits and the sum of the credits must be identical." Principles of cost or of expense distribution are ignored. Therefore, since they were discussing the problems of manufacturing costs, we must assume that such principles are unknown to their authors.

Formulæ are referred to in the preceding chapters in connection with cost accounting methods. It is upon formulæ that cost accounting relies. In practically every phase of the works on cost accounting it is evident that the authors have mistaken form for essence.

Decade after decade has passed. Methods of manufacture have been improved, machines have displaced wage earners to a large extent, still the cost accounting formula remains practically as it was in the days of hand processes exclusively. Direct wages still is cherished in the mind of the accountant as the basis, or at least a substantial part of it, for the distribution of all items of expense, which, because he does not know how to distribute, he assumes to be unmeasurable.

In connection with the work of the Joint Cost Committee of Paper Box Manufacturers' Associations, of which he is secretary, Mr. Henry L. Stortz, of Philadelphia, made an exhaustive study of the various phases of cost accounting, as presented by the leading authorities upon that subject, together with the weaknesses of each, for use in connection with the paper box industry. The author feels that this report, prepared primarily for the purpose of determining what method would be best for the industry, will be of interest to the trade.

Mr. Stortz says:

"The fact that a Joint Committee has been instituted, representing the organized portion of the paper box-making industry, with the specific purpose assigned to it by the several associations, of investigating and discussing the subjects of Costfinding and Estimating, with the final object in view of agreeing on a system or method of Costfinding and Estimating that will be practical and applicable to our industry, and that will not only have the approval of the committee, but will be endorsed and accepted by others in the industry, as the approved universal Costfinding Method of the Paper Box Industry, is sufficient evidence in itself that the subject of Costfinding is recognized by the industry as one of vital importance.

"We realize that in taking up this important matter with an earnest effort to attain a conclusion, and results, we are keeping our industry abreast with the times and with modern business thought and method.

"We will endeavor to present the various methods of costfiding in such a way that the committee can intelligently and safely assume the responsibility, as the result of their deliberation, of recommending and endorsing a certain one, to be ac-

cepted as final by the Association and the entire industry of paper box making.

"In general the purpose of cost records and accounting may be summed up under four heads:

1st. To show the actual Cost of operation or performance.

2nd. To serve as a basis of predicting future performances, or in other words a basis for Estimating.

3rd. To show the actual cost of production and thereby establish a basis of legitimate profit taking and Selling Price.

4th. To form the basis of managerial effort toward economy, Cost Reduction and Efficiency.

"It is important, therefore, that we first endeavor to define an ideal system, and with this in mind, try to find the system which will come nearest to it, and apply to our industry.

1. The system should show the actual cost of operation, the facts existing (the records of events), and the resulting final cost sheet should be a statement of actual facts as nearly accurate as practical application permits.

2. The system should be as simple as possible, consistent with the problem in hand and the result needed, but should *not sacrifice accuracy or facts for simplicity.*

3. It should be practical in its application to the industry.

4. Should be of proven merit and not an experiment.

5. The system should be of proven value in creating a simple and reliable estimating method.

6. The system should be a guide to efficient management.

"The factors of cost in a manufacturing industry are three—Material, Labor, Expense.

"Material—It is an accepted truth that the materials in any given lot of boxes can be calculated. Its cost, with a reasonable allowance for waste or spoilage, is acceptable.

"Labor—By keeping a record of the time spent, or the piece work cost, of a given lot of boxes, the amount of money paid out for the labor can be ascertained.

"These items—Material and Direct Labor—may consistently be called ascertainable for tangible costs. The problem that now arises is: What is the best method of distributing the expense? If we solve this problem we have solved the question of a good practical cost system.

"Our committee has made an investigation of the methods in use in representative plants and others, and has found a very wide divergence in the practices followed. Some took their total ex-

penses for the year and found what proportion it bore to the sales, and used this percentage. Some took this total expense and after deducting the profit for the year found what percentage the expense bore to the cost. Some used this percentage added to the cost of material only. Some used this percentage and added it to the cost of material and labor. Some used the percentage and added it to the labor only. Some found what the expense was per thousand boxes and added it to the prime cost of materials and labor per thousand boxes. Some took the profit for the year plus the expense and used this for establishing selling prices. Some figured the cutting room or cost of cutting as an expense and kept no time of cutting. Some considered glue, paste, twine, an expense. Some figured depreciation as an expense, others did not. Some considered executive salaries and what they drew out of the business as profit. Some who owned their buildings did not charge any interest on their investment. In fact in only a few cases, where they had a modern cost system, did we find interest on investment included in the cost, and some we found had no way of figuring their cost whatever, merely making an arbitrary price, based upon guess, and their desire to obtain the order.

I have recently noticed, in a trade journal, an article by a Western paper box manufacturer in which he advocates the use of a 'key.' That is, he finds a factor with which to multiply the cost of labor and materials to give him the selling price. How this is done, in this industry, is a mystery.

"It is needless to say that under such chaotic conditions as the foregoing there would be a wide variation in prices and quotations. I have known of cases where prices, quoted when board was $50.00 per ton, that were lower than the prices quoted when board was $25.00 per ton. This is the condition we want to overcome by the universal adoption of a costfinding method.

"The speaker, having made an exhaustive study of the subject, and having applied a modern cost system in his own plant, is convinced that none of the old methods are correct, and will endeavor to show where they fail to be logical, or in harmony with the facts, in a paper box factory.

"In explaining the difference between the various methods, it will be more clearly shown by quoting from a chapter on this subject found in a textbook of the Alexander Hamilton Institute, of New York, written by Dexter S. Kimball, Professor of Design in Cornell University, and Seymour Walter, Professor of Accounting, Northwestern University School of Commerce.

" '*Distribution of Factory Expense.* It will be clear that while the cost of direct labor and direct material can be allocated with a fair degree of accuracy to the jobs into which they enter,

the problem of distributing the factory expense so that each job shall bear its share of burden, is a difficult problem, and one that seldom admits of accurate solution. It is essential, however, that these expenses be allocated as closely as possible, especially where several lines of product are manufactured. Not only should each production order be charged with expense in proportion to the use it has made of the manufacturing facilities, but if close watch is to be kept of these expenses, their distribution should show the departmental responsibility for their creation.

" 'Nearly all the costfinding systems in use are compromises which give approximate costs only. A number of these approximate methods are in wide use, and it may be helpful to discuss briefly the characteristics and limitations of the most important ones.

" 'The basic principle of all of these methods is to use some tangible factor of the job as a basis of comparison by which to measure the indirect expense which should be charged against it.

" 'It will be remembered that direct material and direct labor are tangible factors that attach themselves to all jobs in a direct and measurable fashion.

" 'The time expended upon a job is also a factor that can be determined accurately, whether it be the time of a workman or the time of a machine that has been used.

" 'Practically all of these systems of expense distribution assume that one or more of these tangible factors is a measure of the proportionate amount of expense that the job should bear.

" 'The most important of these systems will be briefly discussed:

a—Distribution by percentage on Material Cost.

b—Distribution by percentage on Labor Cost.

c—Distribution by percentage on Prime Cost (i. e. Labor and Material.)

d—Distribution by percentage on Man Hours.

" 'A more advanced and more accurate method known as distribution by production factors deserves special attention.

" '*Distribution by Percentage on Material Cost.* In this method of distributing the expense it is assumed that the burden varies directly with the amount, or cost, of the material that enters into the product. *Defects*—It will be clear that in a continuous process involving the production of only one commodity, as is the case in a cement plant, where every particle of the product makes the same use of all of the facilities of the plant, this system will often prove adequate. It is sufficient in such simple cases to divide the entire cost of production by the total weight or volume of the product and establish unit factory costs that are fairly accurate—all that is required is division of expense over a uniform product. If, however, more than one commodity, or more than one variety of the same commodity, is manufactured, this method is clearly inaccurate, unless each unit of each line of product makes equal use of all of the factory facilities. Furthermore, if the cost of the materials is used as a basis, it is obvious that a line of goods involving expensive materials will be burdened more than one in which a less valuable material is used.

"'*Distribution by Percentage on Labor Cost.* In this method of distributing the expense it is assumed that the burden varies directly with the direct labor expenditures on the job. *Defects*—In shops where the product is closely similar in kind, and does not greatly differ in size, this method may, in some cases, give results accurate enough to satisfy the user. It has, however, serious limitations. First, this method does not discriminate between the work done by a rapid workman, and the cost of work done by one less rapid, thus the job which takes a rapid workman, receiving 60c per hour, four hours to complete, is burdened with the same expense as a job done by a slower workman earning 40c per hour, and requiring six hours' time, yet the slower man has greater use of the shop facilities, power, heat, lighting, floor-space, tools, rent, etc., and clearly it has cost more to produce the work with the slow man. Furthermore, because of the decreased rate of output due to the slower man, there is less total output over which to spread expenses, and each part must bear a greater proportion as the rate of product falls. Expense does not vary directly with product, but increases relatively as production decreases.

"'This method also fails entirely to differentiate between cost of large work and small work and the error may become large where the size of product and size of machinery vary widely. Thus the expense charged to a job involving $10 worth of labor, by a mechanic using a file only, is exactly the same under this method as that laid upon a job involving the same labor charge, but done on a very large or expensive machine, requiring the use of much greater floor space, heating, lighting, power and supervision. The work done on a very costly automatic machine will, under this method, bear a very small expense burden though it is evident that the interest charge alone is much greater for the automatic machine, than for the hand work, which may bear heavy expense charges.

"'*Distribution by Percentage on Prime Cost.* In this method it is assumed that the expense varies directly with the Prime Cost (Materials and Labor). *Defects*—This method has the same inherent defects and limitations as those previously discussed since it combines the basis of both. Where the value of the Direct Labor is small compared to the value of the Material, and method approaches the percentage on material plan; on the other hand if the material value is relatively low, the method approaches the percentage on labor plan of distribution, and in either case involves the errors and limitations of those methods.

"'In the general case of a factory making a varied product, one piece may have a relatively high labor value and the very next one have a relatively low labor value, and distribution by this method is, in such cases, not only inaccurate, but illogical. A manufacturer doing a mixed business will find difficulty in competing on jobs involving much material and little labor if his cost is based on this method.

"'*Distribution by Percentage on Man Hours.* In this method of distributing the total expense it is assumed that the expense which any piece of work should bear is directly proportional to the number of man hours that have been expended upon it. *Defects*—This method is no better than the percentage on labor, or any of the other methods so far as the differentiation between

the use of equipment of different value and floor space is concerned. The same hourly rate is applied to a hand worker as is applied to a $5,000 complicated machine. This results in overcharging the cheap product and undercharging the expensive work.

" '*Inadequacy of the Foregoing Methods.* It will be clear that under all the plans of distributing expense that have been discussed, an averaged result is obtained. None of these methods takes account of the fact that expense does not weigh equally over all parts of the plant or productive activities. It is for this reason that these methods apply only with some semblance of accuracy, where the conditions are uniform, where wages do not vary greatly, where the size and character of the equipment do not differ, and where the lines of product are not diverse in character. Where these simple conditions cannot be obtained and accurate costs are desired, the averaging and percentage methods described are not applicable.' "

"We have here the most modern and expert thoughts on the different methods in common use. There is, however, another method. (See 'Proper Distribution of Expense Burden' and Production Factors in Cost Accounting and Works Management' by A. Hamilton Church.) This method has been brought to a very perfected stage of application in the Denham System which I will take up later, but in order to bring the different known methods of cost figuring that are used in the Paper Box Industry to your attention, I propose to illustrate their application by a demonstration—Estimating on a given lot of boxes by the different methods and showing the diversion of cost caused by the different ways of adding overhead expense.

"Because of the nature of the paper box business it is necessary in probably ninety-five per cent of cases to quote prices before goods are manufactured. There is, therefore, a constant tendency to quote prices too low because of the fear of competition and loss of the order.

"It is essential that the estimator have a practical knowledge of the business and a *correct method* of figuring, based on the actual conditions existing in his factory. This, a cost system would give him; and what is fundamentally required therefore, by the industry, is a *uniform estimating system.*

"With a cost system established that gives a proper distribution of the expense burdened, we necessarily create a fundamentally correct estimating system. With this once recognized by the industry, the estimator, with the proper tables of cost of materials, and labor costs, should be enabled to make a reliable estimate of the cost of the product.

"In the estimates here presented, the cost or value of board and materials is taken at approximate prices prevailing at the time they were made. Also the item of waste or spoilage is taken

at an arbitrary percentage and it is not intended that those examples shall be taken as a precedent for establishing an actual cost in any particular plant.

"It is intended by these examples to illustrate the argument, and demonstrate why there is a large variation in prices quoted; and to show the results obtained by different methods of calculation and the urgent need of a universal estimating and cost-finding system:

"We will take a lot of boxes, say 1,000—9 x 5 x 1⅝ cut from 50 Plain Chip—26 x 38—I am taking this size because it cuts clean and is a comparatively simple calculation throughout.

Box		
9x5x1⅝		Lid
3¼x3¼		Like
12¼x8¼		do
3x3	9 out	

Box 112 sheets 50 plain, $70	$3.50	$3.92
Lid 112 sheets 50 plain, $70	3.50	3.92
		$7.84
Put up ⅞ Kraft 13,000	4	.50
		$8.34
2% Waste		.16
Material Cost		$ 8.50

Labor:

Wages only:		
Bending 20c per M boxes	$0.40	
Staying 40c per M boxes	.80	
Lidding up 30c per M boxes	.30	$ 1.50
Prime Cost		$10.00

We will assume for the purpose of figuring expense the same plan that illustrated the hypothetical case quoted from the text book.

(1) We have therefore in the case where expense is figured against Materials:

Materials	$ 8.50
Labor	1.50
100% on Materials	8.50
	$18.50
20% Profit	4.63
Selling Price	$23.13

(2) Expense figured against Labor only:

Materials	$ 8.50
Labor	1.50
100% on Labor	1.50
	$11.50
20% Profit	2.88
Selling Price	$14.38

(3) Expense figured against Prime Cost, Labor and Material:

Materials	$ 8.50
Labor	1.50
Prime Cost	$10.00
50% Prime Cost	5.00
	$15.00
20% Profit	3.75
Selling Price	$18.75

(4) Figured on Hour Basis:

Materials	$ 8.50
Labor	1.50

Labor—
Bending 4 hours
Staying 4 hours
Lidding 2 hours

10 hours @ 25c per hour	2.50
	$12.50
20% Profit	3.12
Selling Price	$15.62

(5) Expense figured on Rate per 1,000 boxes:

Expense 5,000	$10.00
Output 500,000 for period	10.00
$10.00 per 1,000	$20.00
20% Profit	5.00
Selling Price	$25.00

"Here we have a variation of $10 between the highest and lowest Selling Prices,—all figuring a profit of 20% on the Selling Price. If, therefore, you would add the difference due to varia-

tion in profit taking, our difference might possibly be more extreme.

"And this is the simplest kind of a box we can take up.

"It must be here understood that the efforts of the Cost Committee can not be directed toward uniform profit taking and no attempt can be made toward price fixing. The matter of profit taking is one of policy and will not allow of any dictation. All that can be said on this subject at this time is that percentage of profit should always be figured on Selling Price. 'Honest Business requires a fair profit.' No order should be taken that does not include a profit.

"Now, for the edification of the industry, we will carry the illustration still further, and endeavor to find what these various methods show on the same box with an elaborate finish.

"For example, suppose it is to be a telescope covered white glazed, no edge, end label, with 2 lace flies. Tops printed in flat bronze:

Material		Labor	
Box 112 sheets 50 @ $70	$3.50 $3.92	Bending up	$0.40
Lid 112 sheets 50	3.92	Staying	.80
Lining 224 sheets 26 x 38 @ 80c	1.79	Cov. box	$0.50
	$9.63	Cov. lid	.50
Stay 13,000 inches ⅞-stay	.50	Bot. Pap.	.50
Box 150 sheets wh. glz. @ 45c		Top by hand	1.00
Lid 150 sheets wh. glz. @ 45c		End label	.50
Tops 94 sheets wh. glz. @ 45c		Turning in	.50
Btm. 94 sheets wh. glz. @ 45c		Lidding up	.30 $4.80
488 sheets @ 45c	$2.20		$6.00
2 laces 9"—2 out 23" strips 1,000 laces @ 85c	.85		
Printing tops	1.25		
Printing end labels—1 color			
Labels 5x1¼—25 sheets 20x24 book @ 60c	.75		
	$15.18		
Waste 2%	.32		
Glue and Paste 488 sheets @ $1.00 per ream— 2 with end labels and laces	1.00		
Material	$16.50		
Labor	6.00		
Prime Cost	$22.50		

(1) Percentage on Materials:

Material	$16.50	
Labor	6.00	
100% on Material	16.50	
	$39.00	
20% Profit	9.75	
	$48.75	$48.75

(2) Percentage on Labor:

Material	$16.50	
Labor	6.00	
100% on Labor	6.00	
	$28.50	
20% Profit	7.10	
	$35.60	$35.60

(3) Percentage on Prime Cost:

Material	$16.50	
Labor	6.00	
	$22.50	
50% on Prime Cost	11.25	
	$33.75	
20% Profit	8.45	
	$42.20	$42.20

(4) On expense against Hours:

Material			$16.50	
Labor			6.00	
			$22.50	
Bending	4	hours		
Staying	4	hours		
Cover	5	hours		
Bottom	2½	hours		
Hand work	12½	hours		
T. I.	5	hours		
Lid up	2	hours		
	35	hours @ 25c per hour	8.75	
			$31.25	
20% Profit			7.80	
			$39.05	$39.05

(5) Expense on Rate per 1,000:

Prime Cost	$22.50	
$10.00 per 1,000	10.00	
	$32.50	
20% Profit	8.15	
	$40.65	$40.65

"A variation of $13.00 per 1,000 in the Selling Price which may be changed according to whether you figure glue as an expense.

"The same box made on the Stokes & Smith Machine:

9 x 5 x 1⅝

Material		Labor	
Box 112 Shts. No. 50—$70—$3.50	$3.92	Bending up	$ 0.40
Lid 112 Shts. No. 50— 70— 3.50	3.92	Staying	.80
224 sheets 1s, News 80c	1.79	Cov. Box, Cov. Lid } S & S	.40
	$9.63	Lidding up	.30
		Gluing off	.50
		Lacing Machine	.50
13,000 inches stay	$ 0.50	End Label	.50
Box 250 sheets 20x26 @ 2.75—55c			$ 3.80
Lid 250 sheets 20x26 @ 2.75—55c	2.75		
2 laces—1,000 strips	.85		
Labels	.75		
Printing Tops	1.25		
	$15.73		
2% Waste	.32		
	$16.05		
Glue	1.00		
	$17.05		

(1) Against Material:

Material	$17.05	
Labor	3.80	
100% on Material	17.05	
	$37.90	$37.90

(2) Against Labor:

Material	$17.05	
Labor	3.80	
100% on Labor	3.80	
	$24.65	$24.65

(3) Against Prime Cost:

Material	$17.05	
Labor	3.80	
	$20.85	
50% on Prime Cost	10.40	
	$31.25	$31.25

(4) Against Hours:

Material	$17.05	
Labor	3.80	
21 hours @ 25c	5.25	
	$26.10	$26.10

Hours:

Bending	4
Staying	4
B & L	4
Gluing	4
Lacing	2½
End Labels	2½

21 Hours @ 25c

(5) Against Rate per 1,000 Boxes:

Material	$17.05	
Labor	3.80	
	$20.85	
$10.00 per 1,000 boxes	10.00	
	$30.85	$30.85

"A variation of $13.00 per 1,000 boxes.

"You will notice that in these illustrations we have not considered cutting as a separate item of cost. Evidently then, in these estimates, we have either not figured it in at all or it is indicated in the expense. To include cutting in the expenses has the undoubted advantage of simplicity, but, we unquestion-

ably sacrifice facts. It is quite sure that we cannot make a box without a cutting room, and it is a fundamental necessity—but to place it under the Expense Burdens is just as faulty as if we counted all direct Labor under Expense Burdens. It is quite evident that the job accumulates cost in proportion to the time expended on the job in the Cutting Room just as it does in the finishing process. If we fail to consider the cutting room as a direct labor cost, how would we consider the cost of a lot of platforms or blanks on which there was no finishing? Furthermore the expense of cutting bears no relation to the wages or labor time of the making or finishing and we have just as much expense in cutting 1,000 boxes on which the direct labor finishing is $1.50 as on 1,000 boxes on which the direct labor finishing is $6.00. We find, therefore, that where this has been considered a common practice, is to count a certain sum for cutting a given unit as, for instance, 100 or 1,000. This is often done arbitrarily and sometimes is figured at a fixed amount,—irrespective of size. Sometimes it is figured based upon the quantity and size and again on the number of sheets cut. The latter method is probably more nearly correct if the figure bears any true relation to the output of the machines and the peculiarities of the job. Evidently these methods are fundamentally wrong and inaccurate.

"It has not been found practical in the average shop to pay piece work for cutting because of the great variety of work. Therefore, the universal practice is to pay the workman and help by the week, hour or day, so that in figuring the cost of cutting to arrive at any degree of accuracy we must know the time on the job, or, for the purpose of estimating, we should know the average output of the various machines.

"Now, having illustrated the difference in cost figuring caused by the different methods of Expense Distribution we can readily understand why there is considerable difference in prices named.

"We can also analyze the methods and find their defects. We have in none of these estimates taken into consideration the difference in cost occasioned by work done on a costly machine such as a Stokes & Smith, and a cheap machine such as a Hand Topper, or covering machine, or on the tables by hand. The methods illustrated have carried the same average burden on all —irrespective of Investment,—cost of maintenance and supervision—comparing the lowest cost obtained by any method on the Stokes & Smith made box, we find the per cent against labor only, to be the lowest, viz., $24.65, whereas the same box made in the old style way on a Stripping Machine is shown to be obtained by the same method and gives us $28.50. Now, it

is quite apparent that if the percentage of overhead is correct as an average it is too low on the Stokes & Smith Machines and too high on the Stripping Machines and Hand Work and the apparent advantage or reduced cost obtained on the Stokes & Smith Machines is probably overbalanced or at least equalized if the percentage applied were in the proper relation to the actual expense.

"In one case we have a very low plant investment and in the other a considerable higher one. In the case of hand work we have a cheap wooden table, glue pot and brush and in the other a complicated machine requiring power and expert supervision—a very much larger depreciation and consequently a proportionately larger Expense Burden—and if the machines are not kept working, a very much larger expense for idle time.

"We find consequently a tendency to quote very low prices on the class of work made on the Stokes & Smith machines for two reasons—

First. Because where the average percentage of Expense Distribution is used, there is seemingly a very much larger reduction in costs.

Second. The desire to keep the machines going and fully occupied is more intense and prices are affected thereby at sacrifice of profit.

"To summarize the results of this illustration in the order demonstrated we have—

First Method. Per cent against Material.

This is glaringly defective as it makes no distinction between a common box, taking little time and labor and machinery to make and a complicated box taking much time, labor and machinery and skill. The user of this method is immediately at a disadvantage in competition when price of materials advance and increases the inflated prices—making the conditions worse—it has no *Basis* in *Fact.*

Second Method. Per cent on Labor.

This method has an advantage in simplicity in shops where the boxes made are closely similar in kind and do not differ much in size or process of manufacture—but, in shops where there is a larger variety of work from the simplest form of paper box to the complicated fine candy, perfumery, papeterie boxes requiring a fully equipped plant with modern automatic machinery or semi-automatic machinery the method is defective as it does not discriminate between the slow unskilled worker and the quick skilled worker. It fails to discriminate between simple work requiring none or very little and cheap machinery and work requiring expensive machinery and high maintenance

cost—such as for example between Hand Work and the Stokes & Smith Machine work—between Single Machine Staying and Quadruple Machine Staying, etc., or for example between Staying Machines and Covering Machines. It has a tendency to encourage the sale of boxes requiring cheap and low priced labor.

Third Method. Per cent on Prime Costs.

This method has the same defects of both the others since it combines the basic principles of both.

In the case of a factory making a variety of work we may have a box in which the materials are relatively high in value to the Labor. In the next case we may have a box in which the materials are relatively low to the labor. The box, therefore, which has the relatively high material cost will carry an excess of expense which is contrary to the facts as the actual conditions are that the box that requires most labor and equipment should carry the larger portion of expense, so that in comparison it is not as trustworthy as the Second or Percentage on Labor Cost.

This method also will work to a disadvantage in the industry as it does not reward the manufacturer of quality and boxes requiring skill and much labor and machinery in the same proportion as it does the manufacturer of common boxes in which the biggest element of cost is materials. It also fails to discriminate between cheap methods of production and expensive methods. It does not consider the element of plant investment. It fails to discriminate between the high cost machinery and the low cost equipment.

Fourth Method. Expense on Labor Hours.

This seems to be more logical than the others because it takes into account the value of time,—the cost increases and decreases with time,—but, it required close watching of time expended and it does not take into consideration the difference in the cost of labor. For instance, if we had a lot of boxes requiring 10 hours on the Staying Machine at say 30c per hour, the expense would be the same as if we had a job requiring 10 hours of a Lidder Up at say 10c per hour,—or, again if we had a lot of boxes that took 5 hours on the Covering Machine at 25c per hour, making a cost of $1.25 for labor, and on the next job we have one taking 5 hours on the Stokes & Smith machines with expensive equipment and the charge would be the same for expense, although the operator might be receiving considerable more pay on the Stokes & Smith Machine.

Evidently this method is no nearer the facts than any of the others. In fact it has the same defects,—it does not differentiate between the use of equipment of different value and space occupied. When applied to factories making a large variety of

boxes equipped with high priced machinery and facilities, this method will be a disadvantage in making competitive prices on high class hand work and there will be a tendency to encourage the securing, at a loss of profit, of a common grade of work that passes through the factory quickly and that uses high priced machinery.

Because this method does not consider expense burden in proportion to plant investment and floor space, but entirely on the basis of hours expended, there will be no corresponding advantage on work that does not require this high priced equipment. Such work, when possible to secure, will merely be carrying the excess burden of expense unjustly placed on it.

5th. It becomes almost impossible to establish a rate per 1,000 boxes where there is a variety of work of different quality, different quantities and different degree of details—it is evidently only applicable where the output is of very close or similar character as to size, quality and finish and where the runs are very nearly constant. It is also quite evident that the rate per 1,000 boxes is equally defective if we use a uniform rate per 1,000 for a plain unfinished box, where the output is large, as we do on an elaborate finished box where the output is small. It may be applicable to a consumer's plant using one kind of box only and only a few sizes. But it is absolutely a failure when it comes to meet the requirements of the average box shop.

"Apparently we have not found in any of these methods the ideal cost finding system for our industry. Primarily because they do not fit the average conditions found in the Paper Box Industry and because they are not true to facts.

"However, there is a method known to many of us—Cost Engineering, popularly called the 'Denham System.' Those who have used it will agree with me when I claim that it meets the requirements of our Industry, both as to facts established and practicability. This system is up-to-date in its application and is perfectly logical and scientific in its distribution of the expense burden—this is its chief value. All the items of expense are allocated and distributed in their proper relations to the elements involved, and the plant is divided into its various process centers,—each department, machine or group of machines or process accumulates unto itself its proportion of the Expense Burden upon the time the department is running on production, —in other words, the chargeable hours. The result of this data and statistics secured by the system establishes an hour rate for each one of the divisions instituted. For example, in a certain plant we have a rate established for the Cutting Room in which the groups of machines are separated as follows:

Cutting Room.

1. Carvers or Guillotine Knives.
2. Shears.
3. Single Scorers.
4. Double Scorers.
5. Creasers
6. Corner Cutters.
7. Paper Slitters.
8. Stokes & Smith Cover Cutter.
9. Die Cutting.
10. Hand Work and Miscellaneous.

Finishing Room.

11. Flange Stitching.
12. Wire Stitching.
13. Metal Edge.
14. Enders.
15. Staying Machine, 2nd Floor.
16. Staying Machine, 3rd Floor.
17. Gluing or setting up hand work, 2nd Floor.
18. Floor work.
19. Top and Bottom Papering Machines.
20. Stokes & Smith Machines.
21. Covering Machines.
22. Embossing.
23. Hand Work, 3rd Floor.
24. Lacing Machines.
25. Shipping and Delivery.
26. Special Stocks.
27. Merchandise and Materials.

"For each of these divisions a rate per hour is determined, which embodies the proportions of the expenses, according to use, plus the workmen's pay. Rent and heat are charged according to floor space occupied; Plant investment expenses, according to the cost of the equipment; power according to the horsepower hours used; light in proportion to the time used; Factory Administration according to the sales of chargeable hours, etc. Depreciation is taken care of in each department in proportion to the established depreciation for that department. Insurance, interest, in fact every single solitary expense, according to the books of the company, is allocated and distributed by some logical method so that the resulting rate per hour is a true expression of the facts existing for a period of a month, or twelve months, the twelve months period covers all seasons of the year, good and bad. When the system is continued for a period of years it shows the relative costs in lean and fat years. It establishes a safe rate to use for each operation in figuring your esti-

mates. It will show you when your costs are going up; it causes you to look for reasons; it spurs you on to efficiency, and to endeavor to reduce your rates; it helps you in looking for work for the idle machines. It establishes facts.

"The system includes a method of tracing the exact cost of any job, and proves your estimates by facts; it tells you on which jobs you make money, and on which you do not, because it does not use a per cent against labor, or against materials, or against prime cost, or against sales, or against per thousand boxes output. But, the rate established in each department is a true statement of the average cost of running that department for an hour, year in and year out; and it is a safe figure for you to use in your calculations.

"It is impossible for me to give you full details of the system. But I can show you how the system works in its application after the rates are established.

I want to show you how a lot of boxes may be estimated by the same system and how it may be proven. And for this purpose we will take the same lot of boxes used in previous illustrations.

A lot of 1,000 Boxes 9 x 5 x 1⅝ and will figure it made in three ways:

1. Stayed Only;
2. Stripped and Covered on the Stripping Machine and Strip Top Machine;
3. Covered on the Stokes & Smith Machines.

We arrive at the cost of materials by calculations the same as in any of the other methods.

(1) 1,000 Plain Chip Board Boxes, and Lids, Stayed only.

Box		Lid
9 x 5 x 1⅝		
3¼ x 3¼		like
12¼ x 8¼		
3 3	9 out	do

Board in Boxes 112 sheets 50 pl. @ $70.00	$3.92
Board in Lids 112 sheets 50 pl. @ $70.00	3.92
Stay for Box } Stay for Lids } 13 M. ⅞" Kraft Paper	.50
String and Strips	.20
2% for Waste	.17
Total Cost of Material	$8.71

COMPARISON OF ESTIMATE WITH ACTUAL COST

	P. W. Wages		Cost per Hr.	Est. Time H. M.	Est. Cost	Actual Time H. M.	Actual Cost
	Box	Lid					
Material	$	$	$		$8.71		$8.71
Carver			.96	:15	.24	:10	.16
Single Scorer			.80	2:	1.60	1:45	1.40
Corner Cutters			.60	:45	.45	:30	.30
Staying	.40	.40	.55	4:	2.20	3:30	2.03
Bending	.15	.15	.30	3:	.90	4:	1.20
Lidding Up		.30	.30	2:	.60	3:	.90
					$14.70		$14.70
Shipping and Delivery $10.00 per ton of board (1/7 of price @ $70.00)					1.15		1.15
Total Est. Cost					$15.00	Act. Cost	$15.85

(2) 1,000 Stayed Paper Box and Lid. Covered on Stripping Machine and Strip Top Machine.

Box	Lid
9 x 5 x 1⅝	
3¼ x 3¼	like
12¼ x 8¼	
3 3 9 out	do

Board in Boxes 112 sheets 50 pl. @ $70.00	$3.92
Board in Lids 112 sheets 50 pl. @ $70.00	3.92
Lining, 224 sheets News @ $0.80	1.79
Glue	1.00
Stay for Box Stay for Lids 13 M. ⅞" Kraft Paper	.50
Paper for box 150 sheets wglz 20 x 24 @ $0.45 " " lids 150 " " " " " " tops 94 " " " " " " bots. 94 " " " "	2.20
Flies, 2-9" Laces, 1,000 strips	.85
Labels, 5 x 1½, one color	.75
Printing, Flat Bronze	1.25
Strings and Strips	.20
2% for Waste	.32
Total Cost of Material	$16.70

COMPARISON OF ESTIMATE WITH ACTUAL COST

	P. W. Wages Box	P. W. Wages Lid	Cost per Hr.	Est. Time H. M.	Est. Cost	Actual Time H. M.	Actual Cost
Material	$	$	$		$16.70		$16.70
Carver			.96	:15	.24	:10	.16
Single Scorer			.80	2:	1.60	2:	1.60
Corner Cutters			.60	:45	.45	:30	.30
Paper Slitting			.72	:30	.36	:20	.24
Staying	.40	.40	.55	4:	2.20	3:15	1.65
Bending	.15	.15	.30	3:	.90	3:	.90
Lidding Up		.30	.30	2:	.60	3:	.90
Covering Turning In	.50	.50	.55	6:	3.30	5:	2.75
Bottom Paper	.50		.40	2:30	1.00	2:30	1.00
Hand Work	1.00		.55	5:	2.75	5:	2.75
Flying	1.00		.55	5:	2.75	6:	3.30
Labels	.50		.55	2:30	1.38	2:15	1.25
Shipping and Delivery @ $10.00 per ton of board (1/7 of price @ $70.00)					$34.23 1.15		$33.50 1.15
Total Estimated Cost					$35.38	Act. Cost	$34.65

(3) 1,000 Stayed Paper Box and Lid, covered on Stokes & Smith Machine.

Box	Lid	
9 x 5 x 1⅝		
3¼ x 3¼	like	
12¼ x 8¼		
3 3 9 out	do	

Board in Boxes 112 sheets 50 pl. @ $70.00	$3.92
Board in Lids 112 sheets 50 pl. @ $70.00	3.92
Lining, 224 sheets News @ $0.80	1.79
Glue	1.00
Stay for Box / Stay for Lid — 13 M. ⅞" Kraft Paper	.50
Paper for Box 250 sheets wglz 20 x 26 @ $2.75 / " " Lids 250 " " " "	2.75
Flies, 2-9" Laces, 1,000 strips	.85
Labels, 5 x 1½, one color	.75
Printing, Flat Bronze	1.25
String and Strips	.20
2% for Waste	.32
Total Cost of Material	$17.25

COMPARISON OF ESTIMATE WITH ACTUAL COST

	P. W. Wages Box	P. W. Wages Lid	Cost per Hr.	Est. Time H. M.	Est. Cost	Actual Time H. M.	Actual Cost
Material	$	$	$		$17.25		$17.25
Carver			.96	:15	.24	:10	.16
Single Scorer			.80	2:	1.60	1:50	1.45
Corner Cutters			.60	:45	.45	:30	.30
Staying	.40	.40	.55	4:	2.20	3:	1.65
Bending	.15	.15	.30	3:	.90	3:	.90
Lidding Up		.30	.30	2:	.60	2:	.60
S. & S. Machines	.50	.50	1.25	4:	5.00	5:	6.25
Flying	.50		1.20	2:	2.40	2:30	3.00
Labels	.50		.55	2:30	1.38	2:20	1.27
					$32.22		$33.10
Shipping and Delivery @ $10.00 per ton of board (1/7 of price @ $70.00)					1.15		1.15
Total Estimated Cost					$33.27	Act. Cost	$34.25

"These figures are not necessarily an exact rate of costs but the figures given are sufficient for the purpose of showing the method. The tracer shows how the job proceeds through the shop and accumulates the evidence to prove the cost and establish the exact facts of the cost of production.

"It is evident from this illustration that the method of figuring is not only practical but the system is as near true to facts as it is possible to establish;—it is logical, it does not burden the lot of boxes with any part of cost which does not apply to it—for example, if the box is not covered it only absorbs so much of the cost as has been spent on it—there is no part of the covering machine added,—if it is not finished, no part of finish process is included in the overhead,—if there is no paper used then there is no Slitting Machine expense—there is no part of the Stokes & Smith Machine Expense spread over the Expense Burden if the box is not made on the S. & S. Machine.

"In these estimates a method of arriving at shipping and delivery expense is shown which may be new. We are not prepared to say it is the best, but it is certainly practical, logical and has compensating advantages which will be appreciated.

"Shipping and delivering can not be calculated by any process of time as it bears no relation to the labor cost or cost of manufacture, unless you introduce a very complicated system or record to tell you how long it takes to deliver each lot of boxes. Zone systems have been attempted but they are equally unsatisfactory to establish in proportion to the quantity delivered. In other words, it costs you just as much to deliver 100 boxes one mile as it does 1,000, that is if you use the same delivery system for both. When you are taking mixed loads the problem becomes still more complex. However, one fact brought forcibly to my attention—it costs more to deliver 1,000 large boxes than it does to deliver 1,000 small boxes, because frequently we had to make two or three deliveries of the large boxes, whereas the small boxes only took part of a load. We concluded that the cost of handling the Basic Material, board, the cost of storing it, the Investment and Insurance Expense, the cost of labor tying up and the expense of the Shipping Department in handling the boxes after they were made ready for shipping, the expense of horse, wagon and delivery all bore a logical relation to the amount of board shipped, or sold as boxes.

"By this method all the cost of handling board and materials and all the cost of shipping and delivery is accumulated with the cost system netting in Dept. No. 25 and No. 27 and prorated in proportion to the tons of board cut up and sold in one year—this gives us a charge on cost per ton of board, which, added

to each load of boxes, is a practical estimate of the cost of handling the board and shipping and delivery.

"You will notice its application in the cost sheets shown here illustrating the application of the Denham System. This is not strictly part of the system but merely illustrates a method suggested by the writer of arriving at shipping and delivery expense.

"All the foregoing is respectfully submitted for consideration and thought and if through this means the Paper Box Making Industry can be helped to awaken to the urgent need of a Uniform Estimating and Costfinding Method and to the merit of the work which the Joint Cost Committee of the National Federation of Paper Box Manufacturers Association is doing, the writer will consider this effort not in vain."

HENRY L. STORTZ, *Secretary.*

It will be seen from the foregoing statements and examples that cost accounting consists of the facts of expense and production generalized, and manipulated through purely theoretical makeshift methods. Not a single theory offered by the authorities on cost accounting will stand analysis.

Confronted by a demand for information about cost of production, but without the necessary technical knowledge of processes, accountants generally have assumed that the expenses of production could be grouped into three great divisions, material—direct labor—overhead. They hold that the proportions of these generalized divisions found in the business of one year could be used during the next as a basis for making prices, and that the proportion of the overhead to one or both of the other groups, found in the total volume of product for the period, was constant throughout the individual items of which the total was composed.

The slightest effort in the direction of analysis will cause the manufacturer to lose confidence in the cost accounting theories. All of the facts of experience prove them unsound.

Visible evidence of the absence of relation between the amount of wages paid to the worker and the cost of the various operations involved in the manufacture of

paper boxes, is shown in the table and chart presented herewith.

In preparing this data for graphic illustration the operations have been arranged according to the amount of wages paid per hour beginning with the lowest. This gives a better opportunity for comparison than would be the case if presented in the order of the cost system plan.

The figures shown in the table include the hours of each operation chargeable to orders during the period covered. These could not readily be illustrated on the chart.

TABLE SHOWING LACK OF RELATION BETWEEN DIRECT LABOR AND OTHER EXPENSES

Compiled from Actual Experience, "Overhead" 167% on wages.

	Process	Hours	Wage	Result by %	Actual Cost
1	Finger Hole Machine	41	.11	.29	.41
2	Topper	551	.12	.32	.31
3	Stripper (2)	430	.12	.32	.32
4	Girls' Table Work	3270	.12	.32	.31
5	Stayer (3)	175	.12	.32	.38
6	Stayer (2)	145	.13	.35	.40
7	Stayer (1)	946	.14	.37	.36
8	Sheet Cutter	101	.14	.37	.44
9	Stripper (1)	1781	.14	.37	.37
10	Lacing Machine	57	.14	.37	.59
11	Double Corner Cutter	371	.15	.40	.44
12	Extens. Edge Mach. (2)	205	.15	.40	.45
13	Metal Edge Stayer	23	.15	.40	.55
14	Liner	551	.17	.45	.53
15	Single Corner Cutter	120	.17	.45	.44
16	Chopper Saw	17	.17	.45	.74
17	S. & S. Wrapping Machine	1218	.17	.45	.74
18	Extens. Edge Mach. (1)	43	.18	.48	.68
19	Doming Mach.	63	.21	.56	.67
20	Paper Slitter	142	.22	.59	.57
21	Double Scorer	453	.22	.59	.57
22	Seybold Cutter	301	.25	.67	.68
23	Shears, Men's Hand Wk.	56	.25	.67	.62
24	Quadruple Stayer	116	.25	.67	.89
25	Double Ender	7	.25	.67	.96
26	Single Scorer	641	.26	.69	.54
27	Single Ender	182	.29	.77	.71

CHART SHOWING LACK OF RELATION BETWEEN DIRECT LABOR AND OTHER EXPENSES

(See chart on next page.)

Description of Chart—The light continuous line shows the amount of wages paid per productive or chargeable hour of the processes included.

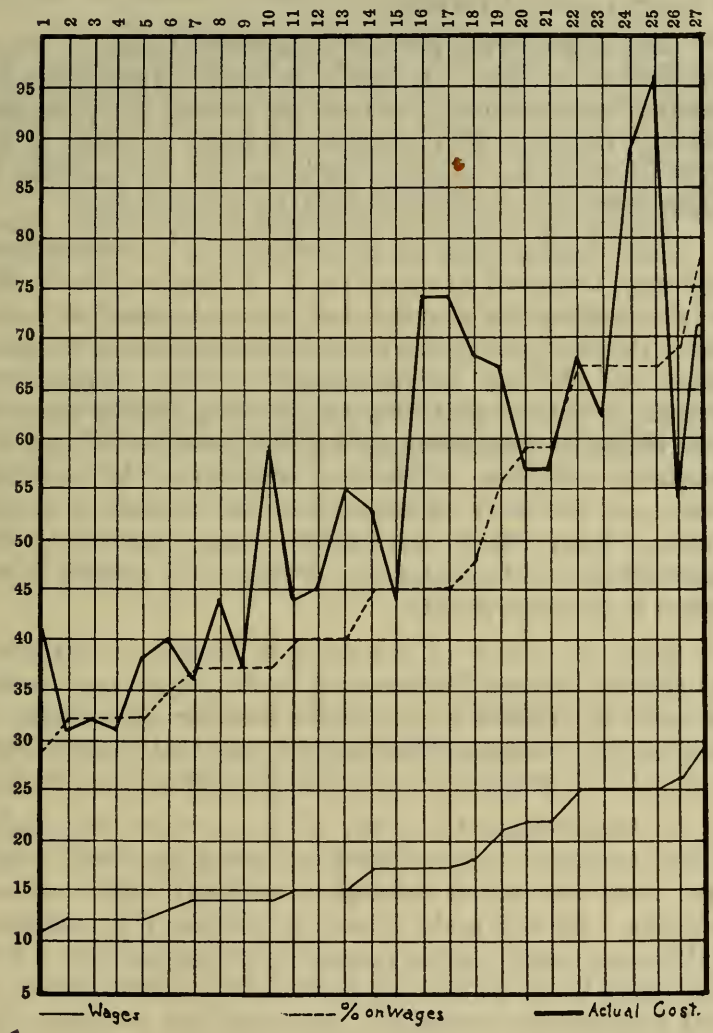
The heavy continuous line shows the actual cost of the various operations or processes as determined by the use of a Cost Engineering system.

The dotted line indicates the theoretical cost of the processes, found under the cost accounting method most commonly used—the addition of overhead to direct wages by percentage. The percentage found by comparing the total of other operating expenses with the payroll of the period was 167.

The numbers at the top of the chart correspond with the numbers of the processes given in the table.

Incidentally this example illustrates how much stronger the variations in figures appear when shown by graphic chart than when figures only are given.

Graphic charts may be used by the management to keep themselves informed as to the fluctuations in both the volume of product and the cost per unit.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5
Wages
% on Wages
Actual Cost.

Cost Engineering has been developed to overcome all of the weaknesses of cost accounting, and differs from it in every essential feature.

Cost Engineering permits no generalization of either expenses or product. It considers every expenditure incident to manufacture as definite in amount, purpose, and benefit. It insists that expenses shall be charged to individual items of product only in the proportions to which they have been benefited by such items.

Cost Engineering in its entirety, is a symmetrical structure, balanced in every part. It requires the reader to take nothing for granted, but demands proof at every step. Persons who lack a clear understanding of its principles, or who are inexperienced in their application, sometimes believe that they can develop results more to their liking by combining part of the practices of cost accountants with those of the cost engineer, or by injecting their own arbitrary opinions into the operation of the system. Such efforts invariably cause confusion, dissatisfaction, and financial loss, whereas the system is designed to increase profits.

Since the object of this book is largely to introduce the subject of Cost Engineering to the paper box manufacturer, to explain its functions, and the advantages of its adoption throughout the industry, several chapters will be devoted to detailed descriptions of methods and usages.

In undertaking the study of this science the reader should endeavor to clear from his mind the ideas which have been developed through familiarity with cost accounting. He will make a serious mistake if he assumes that he can patch up his present information with a few new ideas to be picked up from a hasty observation of Cost Engineering practices. He must not assume, that because the procedure of getting initial data is similar to that frequently used by cost accountants, it follows that the data is to be treated in the same way. He is urged to approach the subject without prejudice, keeping his mind

open for the purpose of getting the proper perspective of the whole subject, and thereby grasping fully the ideas which the author intends to convey.

The true student of Cost Engineering will look upon this science exactly as he would look upon the science of mathematics or chemistry. He will study it to get the advantages offered for his use, and not attempt to change it about in an effort to make it show results which are at variance with the facts of experience. In the long run such efforts have the effect of fooling himself only.

Efficiency consists in obtaining practical results without either waste or strain in the use of time, energy and material. Strenuousness is opposed to efficiency. The degree of perfection required for practicability, and not perfection itself, is the measure of quality. Effort that does not fully serve its purpose is inefficient. A thing done right is done forever.

CHAPTER SIX

Importance of Time Factor in Cost Engineering

Definition of Term "Time"—Product a Combination of Material and Process Time Items—Wages Paid for Personal Time—Piecework Rates Have Time Basis—Machine Time—Manual or Personal Time—All Expenses of Factory Operation Related to Time—Time Reports More Profitable for Cost Work than for Purpose of Espionage—Chargeable Time—Time is Money, a Truism in Cost Determination—The Manufacturer a Dealer in Time as Well as Material—Object of Effort—Profits Not Production—Functions of Time Report—Time Report a Vital Factory Record.

The time element is of prime importance to the human animal. Of no other creature is this true. Shakespeare says: "Time's the stuff life is made of." Pitman, who developed shorthand, used as his slogan "To save time is to lengthen life." We frequently hear the expression "Life is too short," and are told that, because of the rapid means of travel at our command, and the progress made in labor-saving inventions, we live more now in a decade than our forefathers did in a century.

In manufacture, the most important element is time. The value of the material is rarely as great as the value of the time required to form it into the finished articles of commerce.

Under cost accounting the term "time" has generally been confused with the amount of the wages paid for production, especially when the wages were based upon time. The workman calls for his "time," when in reality he demands his wages.

Manufacturers speak of "the cost of time and material," when they mean the expenses of wages and material. The cost of process time is generally unknown to the manufacturer, though the amount of wages paid for personal time is easily ascertainable, hence the confusion of terms.

Items of manufactured product are composed entirely of material and time. The article does not consist

of material alone. The identity of the article is not indicated wholly by the material entering into it. Wool is not cloth, but woolen cloth is wool plus the time of such operations as sorting, carding, spinning, and weaving. The time applied of other processes determines the character of the cloth. Cloth is not clothing, until the time of garment-making operations has been applied.

The finished product of one set of operations becomes the raw material for another set. The time and nature of the operations applied determine the character of the finished article.

Straw, the by-product of the farmer, becomes the raw material of the board-mill. When a series of operations has been applied it becomes the finished article of commerce known as "strawboard." This in turn becomes the raw material of the box factory. When it has been scored, cornered, set up, stayed, or covered and trimmed, it becomes the finished box, required by the maker of candy or other manufactured goods. In his hands it meets another stream of the product of other operations of combining material with the time of other processes. These together meet the product of the packing case manufacturer, which is the result of still other combinations of time and material. Finally it is ready for shipment to the consumer.

The straw of the field could not become the finished box, the sap of the sugar cane could not become candy, nor could the tree of the forest have become the packing case except by the application of time of processes to the materials in transforming them from their raw state through successive stages or operations into the finished articles.

Wages are paid for personal time. Piecework rates are simply another form of computation of the wages of personal time. They are determined by dividing the number of pieces processed in a day, by a reasonably efficient worker, into a fair day's earnings for an employee of that grade.

Process time is frequently not synonymous with personal time. In some kinds of production one person can attend several, say five active machines. In that case the wages of the person for one hour are applicable to five process hours; or, a machine may require five people to attend it, thereby requiring that the wages of five personal hours must be carried on one machine or process hour.

Time, in Cost Engineering, refers to process time unless it is expressly mentioned as personal time. Process hours may be either the time of an individual or a machine, according to the nature of the process.

If the process is a machine process, i. e., if the machine is set to guides or measurements so that the personal element consists in feeding or other effort which may be considered as operating the machine rather than providing the skill, the hour of the machine becomes the unit of time measure for that process.

If, on the other hand, the work is such that the skill depends upon the human element, the process is considered as "manual," and the personal hour becomes the unit of process time.

In the paper box industry, machine processes may be represented by such items as lining, scoring, cornering, staying, slitting, etc. A machine hour may involve the time of several persons, as in the case of a Stokes & Smith covering machine. Manual or personal processes may be represented by stripping, trimming, or other effort, where the equipment is in the nature of tools instead of machinery, and the speed and quality of the output depends upon the individual employee.

Some processes are the result of either machine or manual effort, according to the method employed in the factory under consideration. Covering may be done by hand, or by machine, as may also labeling, lacing, etc. In such instances the words "hand" or "machine" should be used in connection with the name of the process wherever necessary to designate the method employed.

Timekeeping is an essential step in Cost Engineering. In this it differs from cost accounting. In the latter method timekeeping is not considered as necessary on processes wherein the wages of the operator or workman are computed on the basis of pieces.

However, since we have shown that wages are not a basis for the distribution of any other expenses, we must abandon that theory and adopt a practical method.

Analysis will demonstrate that every expense of operation is related to the element of time.

Rent is paid on the basis of time.

Depreciation is calculated on a basis of the length of time that a machine may be expected to give efficient service.

Insurance premiums are payable on a time basis.

Interest is calculated and paid on the basis of time.

Taxes on investment are paid on the basis of time.

Power is calculated on the basis of consumption in its relation to time of operation.

Supplies required by processes increase or decrease relatively to the hours that the process is active.

The Superintendent's attention is required for time of active processes only. He need not supervise idle equipment.

The foremen or foreladies are responsible for the use of the time of both productive and so-called non-productive workers in their departments.

Wages are paid on a time basis, or through piecework rates set on the basis of time.

So we might follow the time element throughout a long list of minor items of expense.

Timekeeping means more than payroll records.

The time report must show the amount of time spent on each order. If it covers a machine operation it should show the time that the machine was running on the customer's orders, and the number of pieces produced on

each, the time required for setting, the time for repairs, or that required for cleaning the machine. It must also show the amount of time that the machine was idle.

If the report covers personal time, it should show the time spent on each customer's order, and the number of pieces produced. It must account for the waiting time between orders, and for any other items of personal time not directly chargeable to the customers.

The time-worker must keep a record of pieces for use in making estimates and developing efficient methods. The pieceworkers must keep time as well as pieces, for the purpose of providing a basis of charging expenses other than wages, and also that cost may be properly determined.

The time report is the fundamental record of a factory. Employer and employee alike should understand that there is a direct relation between the efficiency with which these records are made and the profitableness of the business.

The greater part of the value of the product of the factory is made up of time units. Carelessness in keeping the records or in handling them is certain to result in losses.

The time report in the factory is identical in importance with the charge sales slip in a department store. It is the record of the items chargeable to individual customers, the only means by which the manufacturer may know just what his employees have put into the customers' orders. Carelessness in handling these vital records will create greater losses than those caused by slow workmen.

Time reports were originally introduced as a means of keeping a check on the employee—as a faultfinding device. Their value as a profit-making and costfinding device far exceeds their value from the old standpoint.

Every item of chargeable time not charged to the customers represents its face value in net loss. The pro-

prietor or official of a factory who is too proud to make out a report for such time as he works on chargeable processes is in the same position as the proprietor of a store who hands goods over the counter to charge customers and is too conceited to make a charge slip lest he lower himself to the level of a clerk. To be a clerk is more honorable than to be a fool.

One of the chief reasons that mechanics so often fail when advanced to managerial or executive positions is the fact that they have had an erroneous idea as to comparative duties. They also lack the business training that teaches the value of small things.

Little leaks will sink the ship, and little losses cause business failure. In the aggregate they mount up to large sums. Great transportation profits are built up on the margins of five-cent fares. The highest building in the world was built on the profits from five- and ten-cent sales.

In no sense is it more true that "time is money" than in a manufacturing business. The manufacturer is in a large measure a dealer in time as much as the dry goods merchant is a dealer in cloth. The hours of manufacturing processes have different values, according to their composition, exactly as the yards of various kinds of cloth have different values according to their composition.

Some time ago the superintendent of a large eastern factory showed a disposition to discourage rather than cooperate in the installation of the cost system which his concern had ordered. The cost engineer asked him why he opposed the introduction of the system. He replied: "Our workmen are here to get out the product, not to keep books." The engineer went back at him with "You are wrong. Your workmen are here to make profits for your company. What object is there in getting out product except to make profits? How will you be sure of profits if you do not know the cost of the product?" The superintendent admitted the new viewpoint was correct.

He became a supporter of the cost system and today says that he could not run the factory without it.

Time reports have many uses. They help the foremen; they offer a multitude of eyes to the superintendent; they help, as well as check, the estimator; they serve as a charge slip, as a guide to more efficient methods. They prevent leaks and they help to increase profits. We refer to efficiently planned, properly installed, and diligently used time reports, not the incomplete, poorly kept, carelessly handled, and misused sheets which clutter up the offices of many concerns. There the only use for them seems to be as an excuse for the statement, "We have a cost system of our own, and are not interested in changing it at present."

A time report is a vital record in a factory, but it is not a cost system.

The Law of Equal Reaction was first stated by Sir Isaac Newton. Its application to mechanics has long been taught in every school. The pendulum, the lever, the bow and arrow, are simple illustrations of this Nature's Greatest Law. It applies not only to mechanics, but to economics, hygiene, and all human relations. Briefly, it means that every act, word, and thought has a reaction, either beneficial or harmful, and this reaction is equal to and of the same character as the act itself. This explains why work reacts as strength, and laziness reacts as weakness; why kindness reacts as kindness and abuse reacts as abuse; and why honesty, trust, and other good traits can be developed in others by "example." It is usually applied in connection with the Theory of Averages, and explains why the man who overworks is forced, through sickness, to rest; why periods of corruption alternate with waves of reform; why panics follow periods of abnormal prosperity; and finally, why war and peace come one after the other.—*Roger W. Babson.*

CHAPTER SEVEN

Practical Application of Average Rates

Purpose of Cost System—Unchangeable Nature of Cost of Completed Product—Variation in Product and Demand—Stability of Price Desirable—Peculiar Requirements of Men Who Are Habitually Careless—System Must be Practical Under All Conditions—The Limitations of the Law of Averages—The Use of Averages in Costfinding—Averaging Volume of Product—Averaging Expense per Unit of Product to Determine Cost Rates—Periods over Which Averages Should be Made—Comparison of Monthly and Yearly Averages—High Hourly Rates Not Indication of High Production Cost.

Elsewhere the author has defined the cost of an item of product as the sum of the expenses involved in its production, and has declared it to be definite in amount. The purpose of a cost system is to determine what is that definite amount.

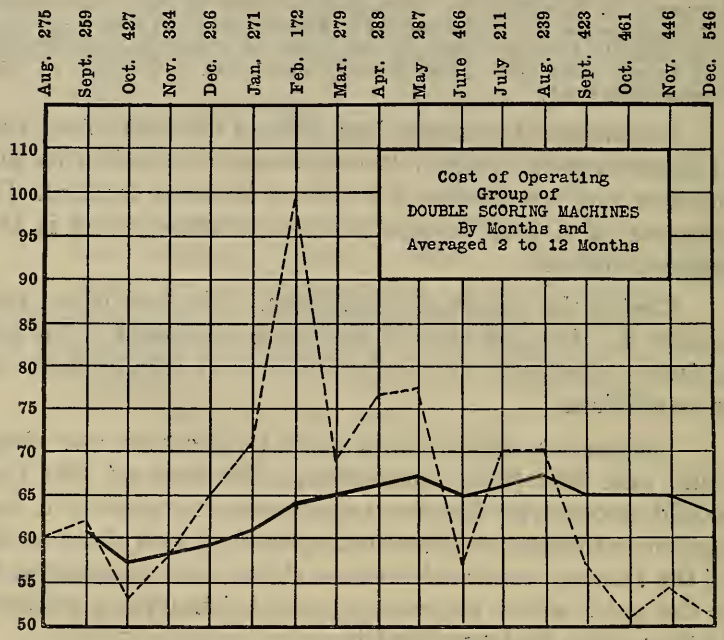
Cost is the result of conditions. The cost of an item cannot be changed after it has been produced. The cost of future similar items can be influenced only by a change in conditions.

Suppose a factory was built to produce one single item, and was then dismantled. The cost of that item would necessarily involve every cent of expense in connection with the construction, operation and dismantling of the factory, and such other acts as were necessary, up to the point where the money provided had been returned to those who had provided it.

Factories are rarely built for such a purpose. They are generally designed for continuous production. A few manufacture a product so uniform, and in such demand, that they can be operated constantly at a uniform rate of output. The actual cost of each item may be said to be uniform with every other item. But this is not true of the paper box factories which have come under the author's observation.

The consumers of paper boxes have many requirements, and boxes must be made to the consumer's specifi-

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR OPERATING DOUBLE SCORING MACHINES



Range of Monthly Averages, 51 to 99, or 48 cents.

Range of Charging Averages, 2 to 12 months, 58 to 67, or 9 cents.

Range of 12 Months' Averages, 63 to 67, or 4 cents.

cations. The businesses of the users of boxes are seasonal, therefore the demand for boxes is irregular. The variety and specific requirements make it rarely possible to build up a stock in the dull season to meet the demand of the busy season. These conditions must be taken into consideration in any plan of costfinding for the paper box industry.

The lack of definite understanding as to what constitutes a cost system is very general among manufacturers. It is the cause of much controversy and many peculiar conceptions.

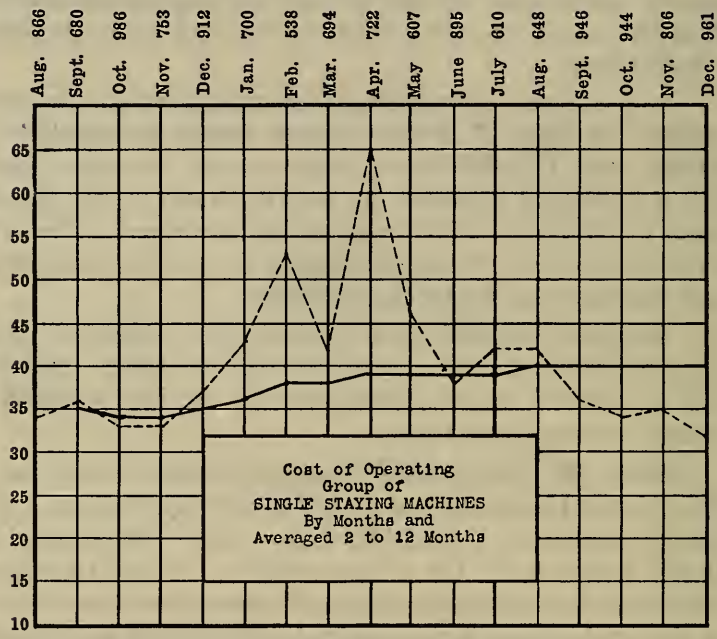
In a serious conversation one manufacturer told the author the kind of a cost system which he wanted. It would show the difference in the cost of an order where the stockkeeper brought the board on his truck directly from the car, which was unusual, as compared to the ordinary case where it was first stacked on the stockroom floor and reloaded on the truck as needed.

Another manufacturer wanted the system to show the difference in cost caused by two workmen spending a few minutes in an argument over the best method of doing a given piece of work.

Since the first instance was an unusual exception to the practical routine, and would not be adopted as a custom for economy, it could have no value. The second instance was a cause for congratulation. While there may have been a momentary delay, the disposition on the part of the workmen to work out the best methods might easily prove a saving rather than a loss and is worthy of encouragement.

It is hardly necessary to say that neither of these manufacturers had anything which resembled a cost system. Deciding to consider a means of finding cost they felt that they could not accept anything short of a degree of refinement which would be impractical and unprofitable in operation. While considering any degree of refinement in a cost system, it is always advisable to compare the value of the result with the cost of the effort

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR OPERATING SINGLE STAYING MACHINES



Range of Monthly Averages, 33 to 65, or 32 cents.
Range of Charging Averages, 2 to 12 months, 34 to 40, or 6 cents.
12 Months' Averages, no variation.

necessary to obtain it. The author believes that if the cost of the effort absorbs the gain, it is unprofitable and not worthy of adoption.

Paper box factories must be operated continuously throughout dull seasons as well as busy seasons. Every day some new contingency arises. The kind of a system adopted must therefore be one which will prove practical under all of the conditions.

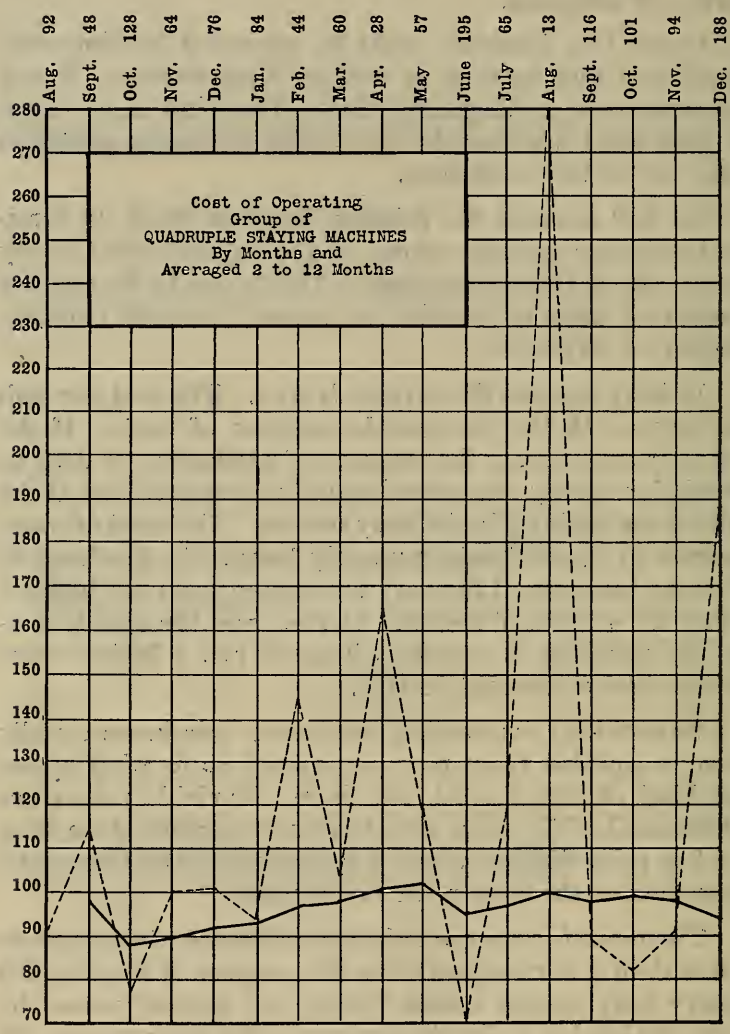
In dull seasons the relation between fixed or semi-fixed expenses and the volume of the output causes a very serious rise in the cost per unit. This is due to the smaller number of units of product as against a nearly constant amount of expenses.

In busy seasons the reverse is true. The cost per unit decreases with the increase in number of units. If the cost of the product at the moment of production is used as a basis for selling, the prices would necessarily rise at the dull season and fall in the busy season. The need of more business at the dull season usually tempts the producer to decrease his price at the very time when costs are highest. When the season of demand arrives, and the cost is lowest, the customer is usually willing to pay a higher price for the sake of prompt service.

Buyers who are making continuous purchases usually form an opinion from past experience as to what a certain kind of box should cost them. Variable prices are detrimental. The man who has once purchased an item at a low price dislikes to pay a higher price at a later date, regardless of the reason for the change.

The manufacturer who in the dull season takes orders at less than a normal price for the purpose of keeping his factory busy simply courts trouble for himself when the buyer wishes his order duplicated in the busy season. If he explains why he made the low price he either starts the customer out scouting for a dull plant, or causes him to arrange his purchases for the dull season, thus spoiling a customer who otherwise could be profitably retained.

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR OPERATING QUADRUPLE STAYING MACHINE


92 48 128 64 76 84 44 60 28 57 195 65 13 116 101 94 188
Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70
Cost of Operating
Group of
QUADRUPLE STAYING MACHINES
By Months and
Averaged 2 to 12 Months

Range of Monthly Averages, 71 to $2.80, or $2.09.
Range of Charging Averages, 2 to 12 months, 89 to $1.01, or 12 cents.
Range of 12 Months' Averages, 94 to $1.01, or 7 cents.

Whether costs are high or low, stable or variable, depends entirely upon conditions. Cost is the result of conditions and can be changed only by a change in conditions.

The ideal conditions for costfinding and pricemaking may be said to consist of a uniform product, a uniform demand, and uniform expenses. Under such conditions selling prices would be uniform, yielding a uniform rate of profit.

We cannot control conditions to an extent which will bring about a set of conditions such as those described. We can, however, by proper consideration of seasons and expenses secure a result which will closely approximate the desired control. This is done through the segregation of elements having the same characteristics and then developing averages.

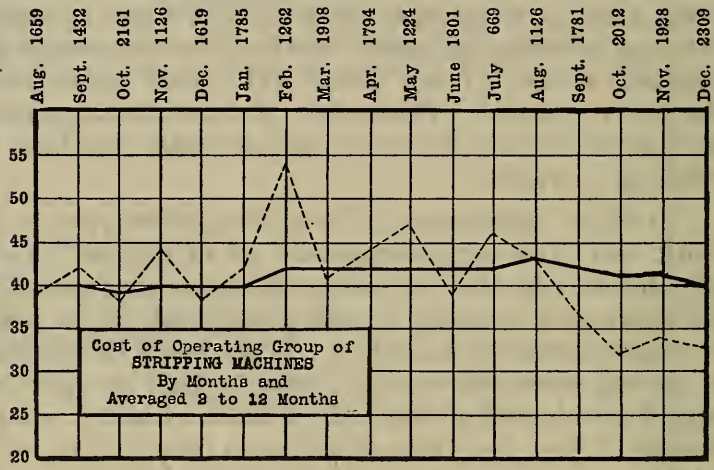
It is not uncommon to hear thoughtless persons remark that "you can average any set of figures." Literally this may be true but unless the items represented by the figures are carefully classified the result of the act of averaging would be worthless. What would be the sense of getting either the average, price, weight, or space occupied by a barrel of flour, fifty gallons of water, seventy pounds of lard, and three dozen yeast cakes, all of which might be consumed in the processes of baking bread.

The foregoing grouping seems ridiculous, but it is not more so than the common practice of cost accountants. They take a large number of unrelated elemental expenses, combine them in a single account and undertake to average them over the wages of workmen engaged on dissimilar processes of manufacture which are applied in extremely variable degrees to an infinite variety of items.

However intelligent these men may be from other standpoints, such methods in connection with manufacturing processes arise from but one cause—ignorance.

Cost Engineering undertakes costfinding through the methods of classification of averageable items, the count-

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR OPERATING STRIPPING MACHINES


1659 1432 2161 1126 1619 1785 1262 1908 1794 1224 1801 669 1126 1781 2012 1928 2309
Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
55
50
45
40
35
30
25
20
Cost of Operating Group of
STRIPPING MACHINES
By Months and
Averaged 2 to 12 Months

Range of Monthly Averages, 32 to 54, or 22 cents.
Range of Charging Averages, 2 to 12 months, 39 to 43, or 4 cents.
Range of 12 Months' Averages, 40 to 43, or 3 cents.

ing, weighing or measuring of the elements required by processes, the charging of each with the amount paid for the elements at uniform rates.

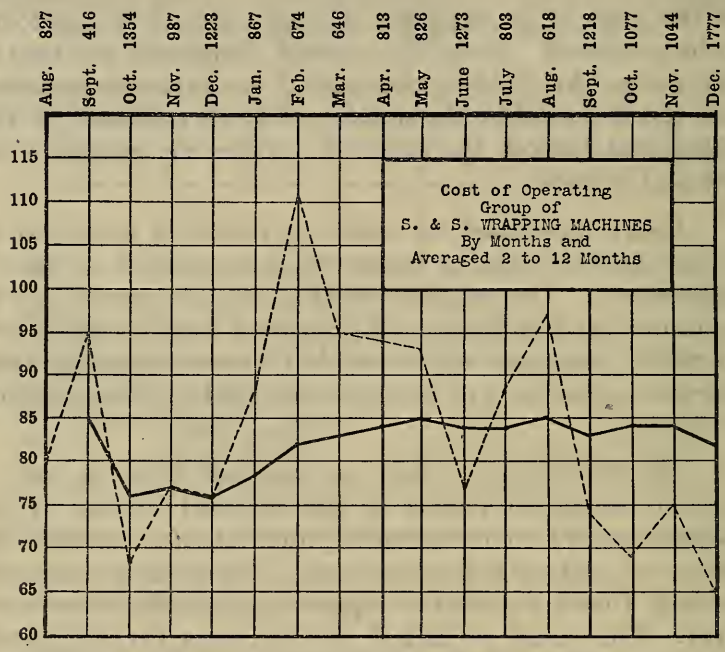
It approximates the ideal condition by dividing the factory into processing divisions, or sub-factories, which produce uniform units. Each of these sub-factories, being charged individually with such expenses as are justly incurred on its account, in turn charges a uniform amount of the total of its expenses against each of the uniform units produced. Since the amount chargeable per unit is determined by dividing the total of the expenses incurred in a given period by the number of units produced in the coincident period, the result is termed an average rate for that process.

Great care must be taken in planning a system to avoid elaborateness, or detail out of proportion to the requirements. The engineer must be equally careful not to combine, for the purpose of obtaining average rates, two or more processes which are not properly averageable. Further attention will be given this subject in succeeding chapters.

The fluctuating volume of product from period to period, as against a more or less constant amount of expenses, creates a corresponding fluctuation of rates at the busy and dull periods or seasons. These fluctuations are usually found to occur at approximately the same each year. The result is that if the expenses for any given processing division throughout the year are combined, and the total divided by the units of product for the year, an average cost per unit will be obtained which can safely be used as a charging rate for determining the cost of the product of such division entering into a given order. It follows that the total amount charged for the units produced in a year must equal the expense of producing the units.

As volume and expense are both affected by economic and political conditions it would still be unsafe

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR OPERATING STOKES & SMITH WRAPPING MACHINES



Range of Monthly Averages, 65 to $1.11, or 46 cents.
Range of Charging Averages, 2 to 12 months, 76 to 85, or 9 cents.
Range of 12 Months' Averages, 82 to 85, or 3 cents.

to use this annual average rate continuously without a means of correcting it.

For practical results, and in order that the management may keep in constant touch with the conditions in the factory, the expenses and production units should be summarized monthly, thus obtaining a monthly average rate for comparative purposes.

The yearly average is then easily corrected by adding to the totals of the preceding twelve months the expense and units of the new month, deducting the expenses and units of the corresponding month of the preceding year, and dividing the new total of expense by the new total of units.

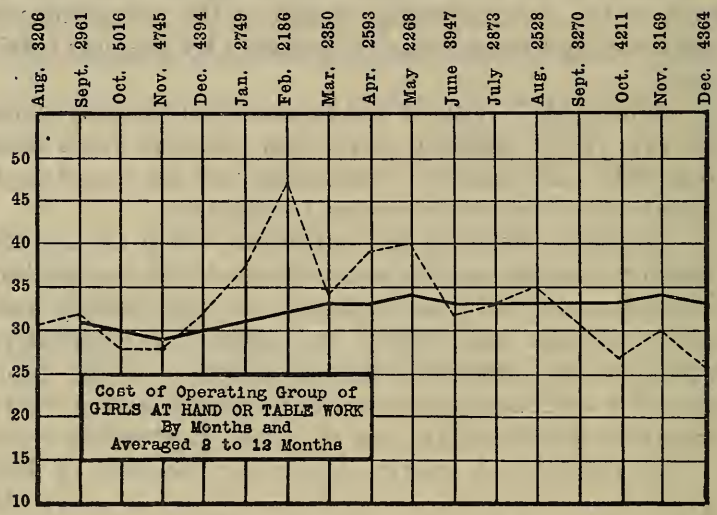
When this is done it will be seen that the yearly average rate rarely changes more than one cent from month to month. The greatest fluctuation will be found on the operations which are operated irregularly.

To fully illustrate the variation which occurs from month to month, and the amount which this fluctuation is reduced under the plan explained of determining a new yearly average each month, the author has secured permission to use the actual figures produced in the experience of a well managed paper box factory during the first seventeen months of the use of a cost engineering system.

In the several charts shown the number of hours of product chargeable to orders is given in connection with the name of the month. It will thus be seen to what extent the cost is influenced by volume of business. Note also that after the first twelve months, although the monthly fluctuation continues, the yearly fluctuation is far less.

There is a common impression that high hourly rates indicate high production costs. There is no foundation in fact for such an assumption. Skilled workers at high wages, with the best equipment and management, are likely to develop a high hourly rate, but that combination can usually be depended upon to produce a much larger volume of output. Very frequently high hourly rates are coexistent with low cost of product. It is the relation of expense to output that is really important.

CHART SHOWING RECORD OF MONTHLY AVERAGE COST PER HOUR FOR GIRLS ON TABLE WORK



Range of Monthly Averages, 26 to 47, or 21 cents.
Range of Charging Averages, 2 to 12 months, 29 to 34, or 5 cents.
Range of 12 Months' Averages, 33 to 34, or 1 cent.

CHAPTER EIGHT

The Compilation and Use of Production Records

How Manufacturers Fool Themselves with Display of Figures —Whose Business Is It?—Vital Nature of Facts—Mistaking Error for Truth—Tendency of the Thoughtless to Follow Traditions—System and Red Tape—Scope of Cost System—Demand for Advance Estimates—Necessity for Production and Cost Records as Basis of Estimates—Records as a Means of Setting Standards—Inadequacy of Delayed Information—Outline of Practical Record —Uses of the Production Record—Machine Builders' Capacity Rating Compared to Actual Average Performance—Records Worthless Unless Used.

Many manufacturers console themselves, and try to fool others, by a display of figures, which they either knowingly or ignorantly miscall a cost system. Often when a cost engineer, or any one else who has had practical experience with cost engineering systems, informs the individual that the data which he calls a cost system is misleading or inconclusive, he is told that "As long as I am satisfied and willing to take the consequences, it is nobody's business but my own."

Such is not the case. It is the business of the stockholder whose capital and income are placed in jeopardy through weak business methods; it is the business of the creditor who risks his money in the account against the indifferent manufacturer; it is the business of the competitor who is obliged to meet the competition of the ignorant; it is the business of the family who are dependent upon him for support; it is the business of the employee whose future welfare is bound up with that of the employer; it is the business of the government which has the right to depend upon him as a source of revenue and to whose interest it is to develop conditions which will insure to all of its citizens the highest degree of prosperity.

In fact, the fabric of humanity is so closely and delicately interwoven that the failure of one individual to recognize his responsibilities affects adversely the welfare of hundreds, and often thousands of his fellows.

The facts of business, the facts of cost, the facts of production, and the facts of profits, are the vital things. The man who indolently disregards them or their warnings, consoling himself with incomplete information and inaccurate figures, is the man who will lose in the test that is bound to come sooner or later with the depressing periods which alternate with those of prosperity.

There is in human nature a tendency to become blind to the things with which we are familiar. Things that once grated harshly on our sensibilities no longer annoy us because we have become accustomed to them through long association.

We get wrong impressions at times. Unless our attention is drawn to them by some compelling force, we assume that error is truth.

In the paper box industry there are men who have entirely erroneous ideas of the effect which the introduction of modern machinery has had upon the cost of producing boxes. They are following traditional ideas taught to them in the days of their apprenticeship.

They think of expense in terms of wages and material. They measure their success by the amount of hustle and worry they have to get orders and fill them. Volume is the big thing in their minds. Profits is an item which they are content to think of only in connection with the statement at the end of the year. If they fear they have had a bad year there will probably be no statement. Their competitors are blamed for all of their troubles. Their factories are filled with inefficient men. Their machinery is inadequate or in poor condition. Stocks are ill kept and run down. Orders are rarely out on time. Their desks are littered with old letters, unopened trade journals and unpaid bills. Because they are busy men they think they are business men.

Talk to them of system and they sneeringly tell you that all system is "red tape." Offer them a service which will help them and they are insulted. Ask them if they

know the cost of making paper boxes and they expose their ignorance by their "cocksureness." Ask them about output and they will tell you that they have the best machinery and the most efficient men in the trade. Ask for definite figures and they will invariably give you round numbers which always means guesswork. They try to create an impression of being informed by belittling the sources of information. They fool nobody but themselves.

To the majority of such the term "cost system" conveys no definite idea. The reason is that in the past there have been as many ideas of what constituted a cost system as there were men to express the ideas.

To those who have gradually evolved something definite the term creates the impression of a plan of records and computations having as its object the limiting of the downward trend of selling prices, so that goods would not be sold for less than their cost.

A cost system, especially a cost engineering system, is all of that and more. It should not only tell at what point expense ends and profit begins, but it should tell what is covered in the unit or item on which cost is determined.

This is doubly advisable in the case of concerns which make product to order. In such cases nearly every customer requests a price in advance. This must be determined by estimates. An estimate is simply a guess made in advance of manufacture upon the basis of such data as the manufacturer may have at hand.

A cost system which determines the cost when the order is completed is valuable, but not nearly as valuable as the system which in addition to determining cost provides records of production in such form as to enable the user to make estimates of the probable cost of prospective orders quickly and with a high degree of accuracy.

A third and no less important function of a cost system should be to furnish the basis of standards of per-

formance which will enable the superintendent to reduce cost.

Many systems are planned to provide certain data at the end of the month, the quarter, or the year. Such are of small value compared to the systems which provide immediate and adequate records. Data that is delayed for months after the occurrences recorded is practically worthless either as cost information, as a means of criticising the operation of the factory, or as a means of planning for greater efficiency in the operation of the processes.

On the other hand, records which show the cost of the order immediately upon its completion do serve as a check against wrong estimates, as a means of weeding out inefficiencies, as a basis for standards of performance, and as a guide to the superintendent in his efforts at cost reduction.

Records of cost and production should always be arranged in such a manner that comparisons can readily be made of the cost of items with item and the output of period with period.

Production records to be practical, must be very simple and easy both to operate and understand. The outline presented herewith will give a comprehensive view of such a record which is in use in hundreds of factories. It lends itself readily both to operation in connection with cost systems of the type to be described in the chapters succeeding this, and for the information of the estimator, that he may make his estimates intelligently in accordance with actual records of performance, under the average of conditions in the individual factory where the product is made.

For this record a form is required which will provide a line for each day of a five weeks period, with provision for totals at the end of each week, and also a monthly grand total.

Headings should be provided for each machine, or

other production center, on which it is intended to keep the record. The machine or other center may be designated by either a number or name. The heading should cover subheadings of five columns, arranged for the recording of setting time, running time, miscellaneous time, idle time, and output. The columns should be arranged in the order in which they are named.

For machines which operate at a practically uniform speed, the entire output can be recorded under a single heading. In the case of machines, the output of which varies with the type of product, it will be advisable to keep the records on the classification of product turned out by the type of machine rather than on the performance of the individual machine itself. In the latter instances the heading over the group of columns should be left blank so that the name, either of the machine or classification of product, may be written in at will.

The time reports of the cost system may be arranged for easy collection of this data if desired, or it may be drawn by a careful clerk from the ordinary type of time report.

The reports from production centers on which it is desired to keep production records, should show separately the setting time; the running time; account for all items of time, such as waiting, or shut down for repairs, when the machine is not available for operation on product; the idle time, which is the amount of the time during normal working hours that the machine is available for production, but has no orders assigned to it. The amount of product should also be given in connection with each entry of running time.

These items of time are transferred day by day to the record of the machine, primarily for the purpose of establishing a basis for estimating, also for the purpose of comparing the performance of different machines and operators.

In cases where the individuality of the machine is disregarded, and the product classified, the items recorded

are entered under the proper classification. This enables the superintendent or estimator to obtain information of value in connection with the comparative time required to put different classes of product through the same process.

At the end of a month, or other period, including several consecutive months, averages of time and output can be made to provide the basis of estimating the time which will be required to perform a certain operation on a given number of pieces.

Dividing the total output of a period by the number of running hours, the average hourly output can be ascertained. This result, divided into the total of a prospective order covering the same class of work, determines the number of hours that will be required for that process, based upon the average conditions. These hours multiplied by the rate which the cost system proves that process to cost per hour, under the same average of conditions, shows the amount which it is fair to assume that process will cost in the production of the order if it is secured.

Taking again the same report and comparing the amount of idle time with the busy time of a certain machine, or group of machines, will show what proportion of time the machines have been available for work that has not been utilized. In other words it shows the relation of output to capacity.

Many manufacturers buy a machine that is said to have a capacity of a certain number per hour. Without making actual tests over a considerable period of time they base their estimates upon the maker's statement of performance.

The maker's rating is based upon the speed of the machine operating continuously under the most favorable conditions. If the purchaser of the machine will but keep the records of actual performance in his own plant he will find that the contingencies of the business reduce its output very materially. It is not uncommon to

find that the actual output of a machine rated by the manufacturer at say 1500 pieces per hour, can be relied upon to produce an average of about 800 per hour. This does not indicate that the maker wilfully mistated the capacity of the machine. He based the claim upon ideal conditions, yet actual conditions in most factories are far from ideal. The production record shows the truth and thereby eliminates much of the probability of loss.

Stoppages, readjustments, etc., are frequently the fault of the employee. The machine record covering the output of several machines of like character doing the same kind of work offers an opportunity to see which operator turns out the larger number of finished pieces. This affords the manufacturer with data which is very helpful in studying the best methods of performing any given operation, so that the best method may be adopted throughout the factory. It also offers an opportunity to compare the efficiency of the employees engaged upon like work.

Considering the amount of time required to set the machines for various orders, gives the estimator an opportunity to determine the saving in time between the long and the short runs. There is a very wide difference between the cost of scoring ten thousand boxes on a single order, and the cost of scoring ten orders of one thousand each. Under the old method of figuring cost on the basis of a percentage added to piecework rates, no account was taken of this difference.

There are many ways in which the production records assist the manufacturer in overcoming the evils of the old guesses and makeshift methods. These were a prolific source of losses.

Production records not only enable you to know what you have done, but they tell you very clearly what can be done. They also make it possible to determine very accurately what it will cost to do any given piece of work.

In the table covering the Average Cost Per Hour of

Processes for 1916, which is included in the Addenda of this book, the average output per hour of many of the processes is also given. In some of the processes there is not sufficient uniformity of units to permit practicable averaging.

The data furnished for the compilation covered six months groupings, so that it is impracticable here to show the range of output as well as the range of cost.

However, in his own factory, the paper box manufacturer has the best possible opportunity to compile or chart the variation of output, so that he can place his employees where they can produce most advantageously, as well as secure the most practical data for making estimates.

It is unfortunate that some manufacturers who have had the opportunity to establish production records have not been inclined to do so. Some of those who have established them but have not been sufficiently energetic to develop the habit of using them. Because it is easier to follow the traditional methods which have become habitual they do so. Both of these types are losers because of their apathy.

The chief opponent of the production record is the incompetent superintendent. He does not want the facts of factory management recorded in a manner which may call down upon himself a serious amount of criticism.

The man who watches his production records daily, and uses them to increase profits and efficiency, will never let them be discontinued.

CHAPTER NINE

Planning a Cost System

Cost System Defined—Function of Cost System—Its Importance—Who Should Operate It—Factors in Successful Installation—Who Should Make Installation—Cooperation of Every Individual Essential—Qualifications of Engineer—Authority and Responsibility—Making Survey—Making Plan—Time and Output Records—Types of Factory Divisions—Importance of Accuracy—Mechanical Recorders—Time Report a Charge Slip—Material Records—Perpetual Inventories—The Cost Memorandum—Tracer System—Inventory of Work in Process—The Record of Hours—Split Time Record—The Monthly Summary—Necessity for Care in Expense Distribution—Advantages of Cost Engineering.

A Cost System is a piece of managerial equipment, intended to keep the management of the factory in touch with every occurrence, usual or unusual, in every division of the workrooms; to determine where expense ends and profit begins on every factory order; to show which of several lines of product is most profitable, and to what extent; to show by comparative records the cost of production under various methods of operation; and to show the measure of output within the time unit for purposes of estimating on future production, and the setting of production standards.

A Cost System has many functions and touches the most vital interests of a manufacturing business. It should be planned to meet the individual requirements of the individual business in which it is to be operated. It should never be left exclusively to the care of clerks. It should always have, as its chief, a man who has the interests of the business at heart; a man who has the ability to see that it is an index of conditions, who knows how to analyze its indications, and the authority to take action in accordance with them.

A Cost System should be recognized according to its merits. It should never be allowed to take a position secondary to any other clerical work. Definite persons should be assigned to keep its records up to the minute, that it may be ever ready for the inspection of the man-

agement, and reveal the otherwise hidden leaks of the business, for the prevention of losses.

Success in the installation of a cost system depends upon many factors. The engineer who makes the plan must be competent to do the work. He should be a factory trained man. The most able accountant will fail unless he has had in addition to his accounting experience considerable factory training. Experience with a large number of students of cost engineering has convinced the author that accounting experience, especially cost-accounting experience, unfits a man for this work.

There must be throughout the entire factory and office organization a willingness to cooperate fully with the engineer. The management should recognize that any person who refuses to extend his cooperation to the successful installation and operation of the system, is a menace to the success of the business and should be eliminated therefrom.

The qualifications of the engineer, other than a factory training, should be, an analytical mentality; infinite patience; the ability to make a clear, complete and definite plan; to put the plan into operation; and to teach others to operate it so that it will not be dependent upon his presence. He must have sufficient capacity to advise with the management and hold their confidence; he must know the temper of shop men so that his presence shall not antagonize them; he must know the language of the shop in order that he shall escape the ridicule that is hurled at the man who assumes to be informed about things which he cannot intelligently discuss. If possible, he should be an experienced engineer rather than a novice.

Having selected the engineer, tested his qualifications, and decided to place him in charge of the work, he should be given the full authority which his work demands. It is ridiculous, but a too common practice, to place responsibilities upon a man and demand results, yet keep his hands so tied by lack of authority that success is well

nigh impossible. Authority and responsibility go hand in hand. No man should be burdened with responsibility who cannot be trusted with the authority necessary to achieve successful results.

The first step in the installation of the cost system is known as the "survey." This is preliminary to the plan. The engineer must be fully informed as to every operation or process within the scope of the factory. He should list them, note their arrangement and the established practice in routing work through the plant.

In making the "plan," he must avoid duplication as far as possible. He should make the smallest practicable number of processing divisions, keeping in mind constantly the rule that two or more processes can be grouped for the purpose of determining the average cost per unit, only when their important expense factors are in approximately uniform proportions.

The following list will illustrate the divisions common to a set-up box factory:

Liner; double scorer; single scorer; double corner cutter; single corner cutter; stayers, grouped according to size; quadruple stayer; single ender; double ender; stripper; topper; wrapper; extension edge machine; lacing machine; paper cutter; paper slitter; gummer; shear; men's hand work; girls' table work.

Provision must be made for the recording and compilation separately of the amount of time of each process that is applied to each order, the amount of output on each task, and the name of the employee doing the work.

Whether the employee reports on a separate slip or card for each task, or the report is arranged to cover all tasks included in the day, is immaterial insofar as the reporting is concerned. Economy of time for both the worker and the clerk favors the daily report rather than the individual task report.

In designing the time and output report form, separate columns should be provided for the reporting in

connection with each task of the factory order number, customer or description, part of box, operation or division number, the ending time, quantity output, rate, if piece work, amount earned. Additional columns for the use of the office only, arranged to facilitate the assembling, separately, of the chargeable and non-chargeable items.

The report should carry at its head the title "Daily Time Report" and provide for the recording of the name of employee, clock number, date, and starting time. Usually, at the bottom, a space is allowed for the foreman's OK and signature.

On the reverse side or at one end of the report may be printed the instructions for filling it out, with a schedule of the departments, showing the operations or processes covered in each, together with their numbers for reference.

It is inadvisable, in this connection, to show examples of forms. Every factory is different from every other factory and requires that forms be prepared to meet its special plan. The tendency to mistake forms for the system leads many novices to copy or adapt forms designed for other shops with the result that the system is either incomplete, unwieldy, or lacks coordination. A competent engineer will find no difficulty in designing forms to meet his needs.

In making the plan the engineer recognizes three distinct types of factory divisions:

First. The departments, which may, in a strictly set-up box factory consist of groupings of processes, such as preparatory, plain box, fancy box, stock, and shipping; in composite factories they may cover stiff box, folding box, tubing, printing, novelty, raw stock, finished stock, shipping, etc.

Second. The divisions, of which there may be any number within a department. The division covers a group of production centers on which the cost is to be averaged, and usually consists of a number of machines

which are substantially alike and designed to perform the same operation or process. A list of some of the common divisions has been given previously in this chapter. Additional lists will be found in other chapters of this book.

Third. The production center, which is the source of a stream of product, and may consist of a machine with all of the appurtenances and help necessary to produce a stream of product, or it may consist of a person, the table-space and tools necessary for a hand process. In the case of machine centers, it sometimes requires several persons, working in a gang, on a single process. Then the pay of the entire gang becomes part of the expense of the center or unit. Exception to this rule is made in the case of machines where the number of people varies on different orders; then the regular minimum crew of the machine is chargeable to the process and the extra people are charged to the order as helpers, at the wage rates only.

It will thus be seen that the plan of the factory consists of a number of departments, each of which consists of a group of classified processing divisions, each of which again in turn is composed of one or more similar machines or production centers, from which production reports are required; and which are grouped together for the purpose of obtaining an average hourly rate of cost.

The time report is the initial record from the operating divisions of the factory. Accuracy or inaccuracy in making the initial records determines the accuracy or inaccuracy of the final result.

Experience proves that the hand-written report, when made by intelligent, conscientious employees is the most reliable and satisfactory.

Mechanical time recorders do all that the makers promise, which usually is to record the moment at which the card or slip was put into the machine and stamped, or as is the case in a few instances it may both stamp the instant and automatically calculate the amount of elapsed time.

If the employee fully understands the function of the time report as a charge slip, and is conscientious, it is unlikely that false reports will be made. If the employee is given to understand that the report is part of an espionage system, intended to give an unreasonable "boss" excuses for finding fault, it is altogether likely that the element of fear will lead him to avoid as far as possible admitting inefficiency in the reports. Such use of the report defeats the object for which it is installed.

Simultaneously with the reporting of the time of processes by the factory operators, a report must be established which will facilitate charging to each order every sheet, or other unit of material which is issued from the stock room. Every item of material used as supplies for the processes must be charged to the process consuming it.

Material is the term applied to the items which enter into and become a part of the finished product. Charges for material are made directly against the factory order covering the product in which the material is used.

Supplies is the term applied to items consumed in the processes of manufacture but not becoming a part of the product. In some instances the same item may be issued either as material or as a supply item, according to the use to which it is put. Occasionally a case arises where an item of material may be more readily chargeable as a supply. Wire on a stitching machine is so treated in some factories, where the stitcher work is likely to run fairly uniform. Great care should be taken in deciding which method to pursue.

This is only one of hundreds of instances in the installation of a cost system where the experience of an engineer is important. Apparently trivial items, when improperly charged, may develop important discrepancies when the volume of production is multiplied annually into hundreds of thousands or millions of items.

It is always advisable to operate a requisition system and perpetual inventory in connection with stock and supply rooms. This prevents the issuance of any mate-

rials or supplies without authority from proper persons. It makes some person definitely responsible for the investment carried in merchandise. It makes it possible to trace lost items and to prevent much from being lost. The requisition serves as the fundamental record for both the charging of the material or supply item properly, and for the perpetual inventory.

The carefully operated perpetual inventory has many functions. It prevents overstocking; shows quickly the materials available for the production of any order; warns when the stock reaches a predetermined minimum; is indispensible in making a financial statement for the purpose of obtaining credit; and is of great advantage in case of adjustment of fire losses.

Perpetual inventories should cover all stock items, equipment, supplies, and work in process. A competent engineer should have no difficulty in preparing forms and instructions for the installation and maintenance of such inventories in connection with the installation of a cost system. In the properly planned cost engineering system, the file of cost memorandums covering incomplete orders serves as an authentic perpetual inventory of work in process, expressed in units of process time, and material items, but which can through known costs be quickly converted into money values.

The Cost Memorandum, serves primarily as a ledger account against the factory order. It also has other functions. As mentioned in the preceding paragraph those on which the record is incomplete provide a very practical perpetual inventory of work in process. It may be recognized as an authentic tracer system, showing at any date just what progress has been made on any order in the factory; who has done any part of the work on it, and when delivery has been promised. When the order has been completed, it shows the cost of the materials entering into the order; the amount of time and expense of each of the several operations involved in the work. It is a source of information for compiling data for making

estimates and a competent basis for checking the accuracy of estimates. It shows the total cost of each order, the amount of profit or loss on each. It is a prolific source of information for the superintendent, the accountant, the estimator, and the manager.

In preparing copy for the Cost Memorandum in connection with a cost engineering system in a paper box factory, provision must be made for recording or charging all items of material required by the order. Groups of columns under divisional headings should be provided for the recording of the time of processes. Under the divisional headings there should be columns allowed for the date, employees' clock number, amount of time, and number of pieces finished. Economy of space may be effected by providing groups with printed headings for such operations as are common to set-up boxes, such as scoring, sheet cutting, corner cutting, staying, etc., and groups with blank spaces for other operations which may be written in by the clerk who makes the records. In shops where piecework prevails and the wages are considered specifically, in connection with process hour rates exclusive of wages, it is necessary to provide under each heading a column for the entry of the amount of piecework wages.

Provision must be made on each cost memorandum for the assembly of the totals of time and wages on each process, as well as the total cost of materials. This should correspond as nearly as possible with the estimate form to facilitate the checking of estimates, an advisable proceeding in each instance where a loss is shown, or where the amount of profit is less than a satisfactory percentage of the price.

A Record of Hours affords the means of crediting each producing division with its product, expressed in terms of time. This record ordinarily consists of sheets or pages arranged to cover a period of five weeks, permitting totals to be made weekly and monthly. Sufficient double columns must be provided under divisional head-

ings for recording, separately, the division totals, daily, of the chargeable and non-chargeable hours. At the end of the month the total of the divisional expenses is divided by the monthly total of chargeable hours for the purpose of determining the average cost per hour for the month just completed. The grand total for a series of months, preferably twelve, divided into the total expense of a coincident period, determines the true average cost per hour for the period.

In factories where employees are likely to work in several different divisions during a pay period it is sometimes advisable to use, instead of the ordinary hours record, a Split-time and Payroll Record.

The Split-time and Payroll Record is made to cover the record of one employee for one five-week period, or month. Space is arranged at the top of the clock number and name of the employee, the month, and time rate of pay. At the left hand side space is provided for the dates. Across the page, under four or five divisional headings, which may be written in as required, are groups of columns for recording under sub-headings, the chargeable hours, non-chargeable hours, output, piecework rate, and amount. This is ruled for both weekly and monthly totals so that wages may be totaled weekly for payroll purposes, and hours and output monthly for costfinding purposes. Variations from this description should be made to meet the special requirements of the case in hand.

When the Split-time and Payroll Record is used it is not necessary to use the Hour Records form previously described. The engineer should determine which is the most practicable method for the individual case in question.

The Monthly Summary of Expenses, or Cost Record, is the final and pivotal form of the Cost Engineering System. All of the previously described forms, except the Hours Record, are more or less similar to forms included in the cost accounting systems which have generally proven inadequate for modern requirements. In the

Monthly Summary has been developed the most comprehensive analysis of expenses possible at this writing.

Once each month, preferably as soon as the trial balance of the accounting system has been completed, the accountant or chief cost clerk should work out the summary.

On this sheet every expense of every kind is analyzed and distributed in such a manner that it is impossible for one process to carry any expense not involved in its operation. The refinement to which distributions can be carried out makes any degree of accuracy possible.

The Summary form provides a series of columns, one for each division, including not only processes but office and stock divisions as well. At the left should be placed the titles of the expenses in the order in which distribution is to be made.

Expense items may be grouped for distribution simultaneously only when they have the same object and the proportions of benefit to factory divisions are identical. Thus it will be seen that under ordinary conditions rent and heat, which are both directly related to space required, may be grouped and distributed upon the basis of area. Exception should be taken to such grouping if the type of building construction required by different divisions involved different investment, if certain areas are heated to special temperatures, or if located in a retail district and a store is operated in connection with the manufacturing business.

More will be said of the matter of distribution in the succeeding chapters. This instance is used to show the care with which provision must be made in designing the summary form, so that only such items as may be correctly distributed in the group shall be included in the grouping arrangement.

The particular design of the form is immaterial, beyond the provision for distributing the expense items to the divisions in the proportion in which they have benefited.

Expense groupings may or may not, at the discretion of the engineer, be provided on the summary form. Data for use in making the distributions may be included or excluded at will. But the expense items must be arranged and distributed in such a manner that each process shall be charged with exactly that proportion of each expense which has benefited it and no more. The total of the divisional expense divided by the number of chargeable hours of a coincident period will determine the average cost per hour for the period.

The chief advantages of Cost Engineering are the comprehensiveness of the factory data, the accuracy with which indirect expenses are distributed, the practicability of the resultant rates as a means of determining the factory order cost, and the simplicity with which the correctness of all showings may be proven.

So far as possible, a man should push a job through to a finish when once he has undertaken it. To some sort of a finish; if not of the whole job, then some complete separate part of it, something definite, that can count as a bundle by itself, and which, when it is tied up, is really out of the way. Don't break things off in the middle. Don't keep having to get at a thing. When you have to take your attention by the scruff of the neck every minute or two and force it back on the scent, you are making a terrible and useless drain on your will power.

Another practical conclusion is this: As far as possible bunch the little things you have to do so as to make one larger job of them. If you can make a list of the minutiae that need attention, and then go at them with a running start, the end will be reached—not necessarily quicker, yet certainly with a tremendous saving of energy. —*"In Office."*

CHAPTER TEN

Installing a Cost System

Difference on Factors—Inaccuracy in Rate Compared to Inaccuracy in Result—Why Manufacturers are Satisfied with Inferior Systems—Many Concerns Insolvent Without Knowing It—Losses Unrecognized Because Records are Inadequate—Law of Action and Recreation Inexorable—All Losses Must be Offset by Gains Before Profit Can be Realized—Financial Bankruptcy and Moral Bankruptcy—Profitableness of Following Instructions of Engineer—Making Installation—Instructing Workmen—Foremen's Duties—Cost Clerk's Work Outlined—Finding the Lot Cost—Comparison of Cost with Estimate—Filing Records for Reference.

In no two factories are the conditions alike. For that reason any general description of a cost system, or instruction for operating such systems, is to be undertaken with great caution.

The Cost System is the most vital of records used by manufacturing concerns. The accuracy or inaccuracy of the cost system guides the business toward success or failure.

The reader must realize that an inaccuracy which would be insignificant in a result may be serious in a rate. A fraction of a cent in the rate, multiplied by the thousands of units to which it is aplied, can create great losses. An inaccuracy in a distribution rate is multiplied in the act of distribution by the number of units involved. This again is multiplied for any mass of hours on which the erroneous rate is used.

Lack of information, or indifference to the importance of these truths, leads many manufacturers to be satisfied with a system which though inaccurate seems "good enough." They rest in confidence that they know their costs, because they have a "Cost System," until bankruptcy stares them in the face. Many concerns are insolvent and do not know it. Even an insolvent concern has a chance to get on its feet if the management discovers the condition before the creditors do and acts immediately.

When it is realized that a manufacturing concern can

lose ten per cent of its capital yearly and remain in business for about fifteen years, it will be more clearly understood why manufacturers do not more quickly pay the penalty for wrong methods.

The average manufacturer, aided by the accountant who either wishes to please or is afraid to stand against the employer, and abetted by the fact that the accounting profession itself has failed to establish definite principles and rules of procedure, manages to salve his conscience by omitting economic expenses in his statement. He thus fools himself into the belief that he has made some profit, or at the worst has "broke even."

"Hope springs eternal in the human breast." Even though a loss is admitted, he anticipates that the pendulum will swing the other way and that a good season will carry him over onto the profit side before it is too late. Sometimes it does. But, generally, the plant changes hands. Someone else puts in new capital and keeps up the merry round, clinging to the belief that "If we can only keep the wheels turning we must be making money."

The law of action and reaction is inexorable. What is lost on one series of transactions must be more than gained on others before there can be a profit on the whole. The longer a manufacturer waits before he grasps the truth that there can be no advantage under any circumstances in taking an order at less than cost of production under normal conditions, the greater becomes the barrier to future success.

Man-made legal codes enable a man to get out from under the burden of financial bondage, through the bankruptcy court, but there is no bankruptcy act which will relieve him of the moral responsibility that follows in the wake of careless business methods. He must recognize and conform to the law of compensation or pay the penalty in failure. The fundamental principles of the universe are unyielding in their action. "Whatsoever ye sow, that shall ye also reap."

No other effort will yield as large results as the atten-

tion given to the study and use of the data afforded by the cost system. Unless such effort is applied it is of little value, barely worth keeping up. The value of the results obtained will depend upon how closely the instructions of the engineer are carried out.

At a predetermined date, after the forms described in the preceding chapter have been printed, the real work of installation is begun. At this time the plan should be complete and carefully checked for omissions or errors. If possible a conference of all officials, including foremen and foreladies, should be held, at which the plan should be outlined, the object of the system explained, and the full co-operation of everyone assured.

Each workman in the shop, engaged in productive operations, should be provided with time report forms, and personally instructed in making the necessary records. If the daily type of report is used, he should at the beginning of the day enter at the top in the spaces provided therefor, the date, his name, clock number, and the time when he starts work. On the first line under the proper headings the order number, the name of the customer, or the name of the job, the kind of work (by number, if processes are numbered), and if the work is done on a machine the machine number should be given.

When the task is finished, the time at which the task ended should be recorded under "Ending Time," and the number of pieces finished written under "Output." In recording time on operations the employee should not compute the amount of elapsed time. He should enter the time by the clock at the moment of completing the task. Time may be expressed either as hours and minutes, or by the more advanced method of hours and tenths, or hours and hundredths. Dials to be applied to ordinary clocks, and especially designed for the decimal showing of time, can be purchased for a nominal consideration. These facilitate the addition of long columns of time, making it possible to do the work with an ordinary adding machine.

When the second task is taken up, the order number and other data is written as in the first task. This procedure is continued throughout the day on each task. In case of waiting time or other delay, the cause of delay must be given on a line at the point in the day's work where the incident occurred so that all time items will be kept in their consecutive order.

The employee should be fully instructed in the use of the time report so that any prejudice which he may hold against making such records may be overcome. If he is convinced that the records are primarily intended for use in making accurate charges to orders, little difficulty will be had in getting his co-operation.

The engineer should visit the workrooms at frequent intervals for the purpose of answering any questions that may arise. He should instruct the foremen fully in methods of watching the time reports, as he makes his rounds, to see that records are properly made up at the proper time, not left until a "convenient" time, usually at the end of the day.

All time reports should be filed with the foreman at the end of the day's work. He should put his O. K. on such as are in his opinion correctly filled out. The entire file should be placed in a safe or vault. It must be kept in mind that these reports and the resultant postings represent their face value in money, as surely as do the charge sales slips of a retail store.

The clerk having been selected to do the posting which will carry the records forward to the orders, the engineer will on the following morning give him instructions in handling the reports and making the postings. This procedure will vary, of course, with the variations in form of report used, but in the case of a daily report covering time and piecework would be substantially as follows:

(a) Examine all reports to see that they have been properly made out. If not, such reports as are wrong should be taken back to the workrooms for correction.

Both the engineer and clerk should go together to the foreman and explain the error. Then the foreman should take the report back to the workman responsible. The engineer and clerk should never go "over the head" of a foreman directly to the employee, unless the foreman requests them to do so.

(In every factory there should be a definite plan of organization with definitely assigned authority and responsibility to each person. That line of authority should never be broken or disregarded except in case of emergency, when it becomes the duty of every individual to do his best for the interest of the employing company. Factory discipline can in no other way be maintained without friction.)

(b) Note the starting and ending time for the day, and see that they correspond to the time punched on the "In and Out" clock, both forenoon and afternoon.

(c) Calculate the elapsed time on each item, extending the results into either the chargeable or non-chargeable time columns according to the nature of the individual items.

(d) If the work is piecework, enter the rate in rate column and extend the amount of earnings into earnings column.

(e) Total the number of chargeable and non-chargeable hours for all the workers in each process division, entering the total of each class under proper division heading in the columns provided.

We are now ready to make the postings directly against the orders. The file of cost memorandums being provided, as described in the preceding chapter, the chargeable items are entered on the cost memorandum under the headings which correspond to the divisions in which the work was done. All the essential information should be posted. In case the work is done at piecework rates, the amount of wages should be entered in space provided.

This routine is repeated daily as the regular work of

the cost clerk. After the clerk has been fully instructed, the engineer will be required for consultation only.

In every instance there should be an understudy, so that the absence of any person shall not interfere with the work going forward without delay.

When the posting for the day has been completed the cost memorandums for the finished orders should be withdrawn from the file, and the cost calculated as follows:

(a) Total the columns of time and the material expense, carrying each total to the summary of job cost provided on the memorandum for the assembling of this data.

(b) Extend all items of time work at the full time work rates or total cost per hour. Where piecework rates were applied, the time of the operation should be extended at the rate found for manufacture cost without wages, and the piecework wages also entered in proper places.

When all entries have been made the total cost of the order is found by adding up the expense columns.

If the order shows a loss, or less than a satisfactory rate of profit, the officer of the company who is designated for the work should have the matter brought to his attention. In fact it is advisable, at least until the system has been in operation for some time, to have this official scan all completed memorandums.

Comparison of the data included in the summary of job cost with the estimates, wherever estimates were given in advance, is advisable and will prove of great value to a conscientious estimator.

All completed memorandums should be kept in a file in numerical order for reference in case the order is to be duplicated. A few manufacturers prefer to keep the cost memorandums under the customers' names. This method is much more cumbersome and therefore less desirable.

CHAPTER ELEVEN

Making the Summary

Object of Summary of Costs—Who Should Make Summary—Preparation of Data—Direct and Indirect Expenses Defined—What Can be Combined for Distribution—Generalization Objectionable in Cost Engineering—Arrangement of Expense Items—Effect of Wrong Method of Charging—Why Process Costs Must be Determined—No Expense is Basic—Order of Consideration—Relation of Expense to Means of Distribution—Danger of Indifference to Variation in Conditions—Fundamental Principle of Expense Distribution—Degree of Accuracy Required—Factory Individuality Makes Uniform Systems Impractical—Suggested Grouping of Expenses—Exceptions Likely—Importance of Small Discrepancies—Common Bases of Distribution under Cost Engineering—Variations from Rules Illustrated—Finding the Cost.

The object of the Summary of Costs is to determine the average cost per chargeable, or revenue-producing, hour for each of the several operations or processes entering into the manufacture of the product.

This is done by charging each of the producing divisions with its expenses, and dividing the total expense of a period by the number of chargeable hours produced in the division for which the expense was incurred.

While the making of the Monthly Summary of Costs is usually the work of the accountant, it may be done by some other person with his cooperation.

Preparation for the making of the summary should be begun at the beginning of the first month in which the system is operated, by a plan of handling the expenses which will retain the identity or purpose of each expense.

Expenses are of two kinds: direct and indirect. Direct expenses are items which benefit only one division and are in consequence chargeable in total to such division, no distribution being necessary. Indirect expenses are those items which benefit two or more divisions and must be charged to them in the proportion in which each is benefited.

In arranging the expenses, for ready application to product through the summary, care must be taken not

to combine in a single account two or more items which have different proportions of benefit. This would make it impossible to properly distribute the total.

For this reason the accounting system of the factory should contain no such accounts as "General Expense," "Burden," or "Overhead," but the items ordinarily charged to these accounts should be arranged in a manner that the total of any group can be distributed simultaneously. That is, the proportions of benefit to the producing divisions should be identical, so that when the total of the group is distributed there will be no injustice. Injustice, in charging the expenses to the divisions, is passed on to the customer through the hourly rate for the process overcharged.

As the total of expenses is always definite, whether known or not, any amount overcharged develops an undercharge in some other division.

If every customer bought exactly the same proportion of the product of each division there would be no injustice. But paper boxes are made in such variety that certain lots may take a great deal of the time of divisions which are required but little in the production of other lots. Practically no two lots take the same proportions throughout. Therefore it is very important that charges be made correctly.

It has been customary in the past to assume that the payroll was the first item to be considered. In the old practice of cost accounting this was practicable, because wages was considered a basic expense factor, upon which other elements should be distributed.

No expense is basic. Every item of expense is elemental. None, therefore, has a special reason for consideration as being of greater importance than any other. It follows then that the order in which expenses are considered is purely arbitrary. The best arrangement is thus the one lending itself to quick understanding and to a minimum of entries, recapitulations, and distributions.

Let us then consider them in the order in which they

would occur to us if we were establishing a new factory. We would need to arrange for a building before we could plan the equipment. Following the equipment we must consider power to operate the equipment. Then comes the lighting facilities; supplies; supervision and administration, foremen, and finally the workmen. Thus we find that building expense takes first place in the natural order of expenses.

The statement has previously been made that expenses should be grouped together for simultaneous distribution only when the benefits which they provide for the various processing divisions are in identical proportion.

To provide the building and keep it in proper condition for use, it is necessary not only to arrange for the necessary amount of floor area, but to keep it clean, and heated to a comfortable temperature.

Ordinarily, then, we can combine rent, heating expense, janitor service, and repairs. These are the items covering the requirements. Frequently, manufacturers are heard to declare that they do not have to consider rent because they own the building. In the event of ownership, consideration must be given to the facts of investment, risks, and time. The owner must consider that he is entitled to interest on his investment.

Taxes must be paid on that investment, which includes not only the building but the ground as well. Insurance on the building is a necessary item of expense. Unless a reserve for rebuilding is established, a time will come when the building will be no longer serviceable and there will be no funds with which to rebuild. These items should be considered as representing rental expense, to which must be added the items of heat, etc., exactly as though rent was paid. This may be disappointing to the man who has fooled himself into the belief that he could produce boxes cheaper than his competitor because he owned his building. But it is simple justice and more profitable for him in the long run.

There are many possible conditions which must be taken into consideration by the cost engineer in connection with the handling of expenses. These may affect the ordinary rules of expense distribution.

For example, differences in temperature of rooms is sometimes necessary. In some departments boys or porters who are on the payroll may do the sweeping, instead of having special help for the purpose. Under certain conditions a heavier type of building construction is required for certain types of machines or for carrying large amounts of heavy materials. Special conditions require special treatment for accurate results.

The fundamental principle, each beneficiary must be charged in proportion to the benefit received, never varies. If accuracy is to be secured it must always be recognized. Of course the rules of expense distribution may be very uncertain; e. g., while the rule is that rent, heat, janitor service, and repairs may be grouped and distributed upon the basis of floor area used by the respective divisions of the factory, we find many instances where a strict following of the rule would violate the principle. In such instances we must conform to the principle by establishing special rules to meet the immediate conditions.

The principle of expense distribution is fundamental. It cannot be violated without destroying accuracy, any more than can the principle of gravitation be violated without destroying equilibrium. Rules may be established for guidance under ordinary conditions. But rules must conform to principle, even though special rules must be established for every factory.

The failure of cost accounting has been due to mistaking formula for principle, the blind following of traditional rules instead of the skillful application of well defined principles.

Accuracy is important. But the degree of accuracy which is important depends much upon conditions. There is no such thing within the range of human knowledge

as absolute accuracy. A degree of accuracy practical in one instance might be destructive in another. Some dimensions on the machines in use in a paper box factory might vary a quarter of an inch, others must be accurate to the thousandth of an inch. If the machine builder made all parts with the same degree of accuracy that he must the more important, he would waste time and make the expense of the machines prohibitive. If he permitted inaccuracies at vital points which are permissible at other places, the machine would be impractical if not entirely useless.

Just as the mechanical engineer not only must understand the principles of the seven powers, but must have the skill and experience to apply those principles, so must the cost engineer have the knowledge, the skill and ability, to create a system providing for accuracy at each step according to the requirements of the case in hand.

The reader will have understood clearly after the explanations heretofore given, that any formulae which have been presented have been illustrative only, and are not to be considered as established methods advocated by the author. Any system to be practical must be planned, with full knowledge of the principles of cost engineering, so that the special conditions of the case in hand will be fully met.

Uniform systems cannot be established in multiform factories. Since the conditions in paper box factories differ widely, the scope of this book can be only the general features of the science of Cost Engineering, with sufficient detail to show the necessity for care and skill in working out the problem which the individual factory presents.

With this statement fresh in the mind of the reader, the author presents an outline of the more important expense factors, arranged and grouped in the manner frequently used. The list must not be considered as complete, nor the groupings practical under all conditions.

Building Expense:

Rent, or, Depreciation reserve and insurance on building, and interest and taxes on investment in building and realty.
Heat.
Janitor Service.
Building Repairs.

Equipment Expense:

Replacement Reserve (Depreciation).
Interest on Investment.
Insurance on Equipment.
Taxes on Equipment.

Power Expense:

Total of Equipment Expense on power equipment.
Total of Building Expense chargeable to power.
Repairs.
Wages, Supplies, etc., for power department, including fuel.
Current (if purchased from central station).

Light and Toilet Expenses:

Current or Gas for Lighting.
Lamps, Cords, Tips, Globes, etc.
Water for Lavatories, Soap, Towels, etc.

Factory Administration Expenses:

General Superintendent.
Factory Clerks.
Factory Office Expenses.
Factory Phones, Telegraph and Postage.
Factory Stationery and Office Supplies.
Porters and Elevator Operators.

Commercial Administration Expenses:

Executive Salaries.
Office Salaries, except factory and sales.
Telephones and Postage.
Stationery and Office Supplies.
Bad Accounts and Collection Expenses.

Discounts and Deduction to Customers.
Federal and Corporation Taxes.
Interest on Work in Process.
Interest on Accounts Receivable.
Insurance on Work in Process.
Craft Organization Dues and Traveling Expenses.

Selling Expenses:
Sales Manager.
Sales Office Salaries.
Salesmen's Salaries and Commissions.
Sales Traveling Expense.
Sales Phones and Telegraph.
Stationery and Supplies.
Advertising and Postage.
Samples and Sample-making.
Donations.
Local Organization Dues, Etc.
Finished Stockroom Expense (conditional).

Packing and Local Delivery:
Rent, Packing and Shipping Dept.
Equipment Expense, P. & S. Dept.
Supplies, P. & S. Dept.
Trucks, Stables, Etc.
Wages.

Stock or Merchandise Departments: (Raw and Finished should be considered separately.)
Rent.
Equipment Expense.
Insurance on Mdse. Carried.
Interest on Investment in Stocks.
Taxes.
Shrinkage.
Light, etc.
Commercial (purchasing, etc.).
Transportation.
Supplies.
Selling Expenses.
Wages.

In addition to the above groupings under classified headings there are a large number of direct expenses not subject to distribution but chargeable to each division directly as incurred for its benefit:

Direct Expenses: (Not subject to grouping for distribution.)
- Wages of Foreman (limited distribution under certain conditions).
- Wages of Workmen.
- Spoilage.
- Divisional Supplies.
- Special Equipment Expenses.
- Divisional Repairs.
- Compensation Insurance.
- Workmen's Wages.

The foregoing list must not be considered complete but as illustrative of the rule of expense grouping, with a fair degree of comprehensiveness.

Under certain conditions it may be necessary to deviate widely from the grouping shown. Many of the items may be so involved as to require special and separate handling.

Exceptions to the common rules of distribution, as illustrated in connection with "building expenses" in the preceding chapter, may occur in connection with many items, and undoubtedly will in some cases at every factory.

A Cost System is analogous to a railway system, with common rules representing the main lines and branches, and exceptions being the spurs and sidings. Attempting to operate either with superficial knowledge is likely to result in disaster. Either a switch, or the wrong application of a rule, may seem a little thing in itself, but may create a divergence leading to a destination or result far from that aimed at.

When manufacturers learn the ultimate importance of small discrepancies, as an influence for shrinkage in profits, they will be more likely to appreciate the value

of the services of an experienced cost engineer. Less likely will they be to attempt either to work out the solution of their own cost problems or to entrust this profit-affecting work to inexperienced employees.

In attempting to distribute expenses the reader should keep in mind the fact that each division is chargeable only with such expenses, or proportion of expenses, as have actually been involved in the production of the output of the division so charged.

The common bases of distribution follow:

Building Expenses—Area of used space.

Equipment Expenses—Replacement value of equipment.

Power Expense—Horsepower hours.

Light and Toilet Expense—Personal hours, or payroll hours.

Factory Administration Expenses — Chargeable hours.

Commercial Administration Expenses—Extended values at cost.

Selling Expenses—Extended values at cost, when sold.

Packing and Local Delivery—To be determined by circumstances.

Raw Stock Expenses—Usually applied on basis of cost of stock.

Finished Stock Expense—Applied by percentage to stock carried for customers, or through selling expense, according to conditions.

Foremen's Wages—Payroll hours of divisions supervised by each.

Generally speaking, the use of the thing purchased will indicate the proportions chargeable to divisions. This is not always just. Take, for example, the element of light: The superficial thinker follows the method heretofore always adopted by cost accountants who have

braved the criticism of the profession by attempting analysis, the assumption that lighting expense is chargeable in proportion to the amount of electric current or gas used for artificial light.

Aside from the mechanical use of light, such as blueprinting and photography, the purchase of electric current or gas for lighting is a contingent expense in connection with the use of light, analogous to the expense of repairing a machine. The worker who operates near a window is no less a user of light than his fellow who needs the lamp. As a matter of fact, he has a better light for his work than the lamp user. The purchaser of the product in neither instance is responsible for the plan of the building, the hour of day, or length of day, which makes artificial light necessary in one instance and unnecessary in the other. Nor should the purchaser of either profit or lose because of the arrangement of the equipment, or of any of the conditions for which he is not accountable.

Light is of two kinds. Artificial light is purchased to supplement daylight because it is customary to work at hours or under conditions wherein daylight is not available. Light is necessary for the use of people and must be provided for each person employed in the factory, whether considered a productive employee or not. The difference between the amount used by one individual and another is unmeasurable. Therefore, light expense is not chargeable on the basis of the amount of current used, but on the basis of the time of individuals at work in the factory in any capacity.

Many people will say that light is a very insignificant expense, not worthy of such special consideration. But the distribution of light on an improper basis will affect a rate. The discrepancy will be multiplied a thousandfold on an order involving a thousand hours.

To cover all the points likely to arise in the correct installation of a cost system, would not only take more space than is available in this book, but would be tire-

some to the reader. Therefore, he should remember the necessity for extreme care in everything involved in the creation of rates.

When all the expenses of the factory and its business departments have been properly analyzed, grouped and distributed in proportion to the benefit conferred by each, the cost per hour of each process is determined. This is done by dividing the total of the divisional expense by the number of chargeable or revenue producing hours that have been charged to the factory orders during the period covered by the expenses considered.

"One of the first things that a man has to learn in business is how little he can do by himself. When he finds that out he begins to look around for people to do what he can't.—*Henry Ford.*

CHAPTER TWELVE

Practical Estimating

Records a Safer Guide than Recollections—Laxity a Cause of Inefficiency—Groups of People Change Less Rapidly than Individuals—Stability of Output Average in Individual Factory—Impracticability of Using Borrowed Records—How to Compare Hourly Cost Rates and Production Costs—Basis of Estimates—Example of Estimating from Records—Guesswork Eliminated—Classifying Product for Estimating Data—Estimating is Pricemaking—The Point that Insures Fairness—Estimating Blanks—Fundamental Requirements—Checking the Work of the Estimator—Lists of Materials and Processes—Suggestions.

In the preceding chapters the reader has been shown the necessity for discarding old and adopting new methods; a comparison of the cost accounting fallacy with cost engineering practicability; how all expense factors are related to the time element; why average rates of cost are more stable as a basis of pricemaking; the value of production records; and the modus operandi of Cost Engineering.

He has been shown that cost is the result of conditions and can be influenced only by changing conditions, not by schemes of figuring; that when production of an item is once accomplished, no influence under the sun can change the amount of its cost.

We have no means of knowing the future except by predicting its probabilities upon the past. We know that records of the past are safer than recollections of the past; that compilations of recorded data are a safer guide than confused mental impressions and their resultant conclusions; that while the man who has suffered or lost through moral or economic weaknesses in the past may feel sure that he will do radically different in the future, experience proves that actual changes are slow. In a factory organization which has become inefficient through lax methods, the change is slower. One man may make a strong resolve to change his habits and develop a noticeable change at once. But an effort to synchronize a hundred minds so that they will act in unison, in a man-

ner different from their custom, is a slow and laborious task.

These things being true, records being used to prove their truth, we find it safe to assume that a body of people engaged in the manufacture of paper boxes will, under the same conditions of equipment and supervision, work next week at the same rates of speed as they worked last week; next month they will produce as much in the same hours that they did last month. The average rate of production per hour for one period of six months, or a year, will be about the same as for another.

Now, if records are kept continuously, and the average for twelve months used for one month; and at its close, the new month's record added, dropping off the twelfth month preceding; thus making a new average, eleven-twelfths of the data being the same as in the previously used average, there can be little change in result. The only influence for change will be the difference between the data of the month added and that of the month omitted.

We have shown how little this will affect the average rate, and therefore how safe it is to use average rates of cost in making estimates.

Output records will show even less variations. Machines are driven by the same power, at the same speed, throughout busy seasons, and dull.

If, then, we have known rates of output per hour for the various processes, under the circumstances and conditions which prevail in a given factory; and also have known cost per hour of operation of the same processes; we have unquestionably the safest possible basis for predicting, or estimating, future performance and costs.

It is not safe for one factory to use the records of another factory in making estimates. The "atmosphere" in different factories varies greatly. One factory is managed by an apathetic management and work moves slowly. Every employee feels the influence of lethargy and attunes himself to the slow time of the institution. In another

factory, everything moves by schedules: They are set with the purpose of accomplishing results in minimum time. There is in this case very little lost motion. The employee never has to ask for orders. They are planned far in advance.

It would be ridiculous for one of these factories to use either the production records or the cost rates of another. Slow time usually means low hourly rates of cost, with high production cost, because comparatively few pieces are finished in the hour. Rapid production, on the other hand, will probably influence hourly rates so that they will seem high, yet production costs are likely to be lower than in the other case.

Comparisons of hourly rates in different paper box factories can only be intelligently made if both the hourly rate and the production record are considered.

It follows that the estimates of cost should, whenever possible, be made upon the basis of carefully kept records of the performances of machines and people in the factory producing the boxes.

Under ordinary conditions no two men make estimates that will stand comparison. Estimates in the ordinary sense are purely advance guesses, as to how much it will cost to produce a certain number of boxes of given specifications.

More or less data are used by some estimators. Others make an out and out guess as to the price per thousand that should be charged for a box, without measurements or calculations. Some of these people (and they are usually men whose work is not checked for errors or losses) boast that they can tell within one per cent of what it will cost to make any number of boxes of any given description.

As a rule these people stop estimating as soon as a cost system has been installed. They do not agree with the findings of the system. Whenever they can, they either prevent or delay the installation of the system. It is only natural that they should not like to have their guesses

tested by a mechanically perfect system. It is apt to injure their "prestige."

With a Cost Engineering System such as has been already described, and with complete production records from the factory divisions, the element of guesswork is very largely eliminated from the estimate.

Let us take, as an example, some actual figures from experience in factories where complete systems are in use: In a certain period of time the staying machines were operated 16,665 productive or chargeable hours. The output of these hours was 11,394,948 pieces, and the total cost of operating the stayers was $9,980.87.

By dividing the hours into the total expense we find that the average cost per hour is $.60. Dividing the hours into the production we discover that the average output per hour was 624 pieces, boxes and covers, with four corners each.

If we now have in hand the work of estimating on the cost of making ten thousand boxes, with cover also stayed, we know that it will require the staying operation on 20,000 pieces. We divide 20,000 by 624 and find that it will require 32 hours of the time of staying machines to do the work. The average cost per hour is known to be $.60. We then multiply the number of hours (32) by $.60 to find the cost of staying, which is $19.20.

There is no guesswork about this. It is the average cost of staying average size pieces, under the average of the conditions in that factory.

Some employees may be and no doubt are capable of producing stayed boxes faster than that rate. Others are slower. But the average over the long period balances the slower with the faster.

The estimator cannot know which operator will operate the stayer on this work. If he makes the calculations on the basis of rapid operation, he will be unable to get fast operators on all of the work. Slower operators will take more time and cause an ultimate loss.

However much we may like to think otherwise, it is unquestionably true that the only safe measure of the output of any process is the average for the factory or division. We like to think that we have highly efficient people. We may have them, but their effect is only to raise the average. The fact remains that the average output is the measure of capacity.

Classifications of product can be made to get the average output per hour of different classes of boxes, but classes of employees cannot safely be made to get the difference in cost of the same operation when performed by different classes of help. The class in which the box belongs will not change between the moment of making the estimate and the time of making the finished boxes. But there is no certainty that the work can be given out in the factory to the class of help which the estimator had in mind. The human factor is very uncertain, but the average is safe.

The illustration given will apply to any and all operations or processes in the factory, and is not nearly so cumbersome as it may appear to the reader from the time required to describe it.

In actual practice the cost clerk furnishes to the estimator, each month, a schedule of the operations, with the cost per hour of each, also the output per hour of each on such classifications of product as have been authorized. A column is provided with its heading space marked "1,000." The estimator uses the column for recording the cost per thousand of the item under the costs of the current month and thereby saves the necessity for figuring the same data twice in the same month. For example, in the calculation shown, the cost of staying 20,000 pieces of the medium class was found to be $19.20. The cost per thousand pieces therefore is $.96. The estimator has but to enter under the "1,000" rate $.96, and when he has occasion again to refer to the data, he can use the rate instead of making the calculation.

If desired, the clerks can calculate the rates per thou-

sand, and furnish the sheet with the rates prepared. Old rates should only be used until new data can be determined. As previously stated, an error of a cent in a cost rate will run into many dollars in a month because of the multiplication of the rate. An error in the result of a calculation is of far less importance.

Estimating is pricemaking. Pricemaking is one of the most important functions of management. The profitableness or unprofitableness of the business hinges largely upon the selling prices being high enough to yield a satisfactory profit. Not too high, lest the business be driven to the competitor. There is a point which insures fairness to all.

The cost system provides the data for estimates which will be fair, and, when the product has been made, serve as a test of the correctness of the work of the estimator.

For this reason, the estimating blank of every factory should be designed to correspond in every detail with the plan of the factory cost system.

Every factory differs in the personal characteristics of the people comprising its organization, in the kind and amount of equipment, in the character of product it is designed to produce, and in its methods of operation and routing of orders.

It is, therefore, as impracticable to undertake the adoption of uniform estimating forms as it would be to adopt uniform cost system forms. In many cases the design would be inadequate, in others it would be very cumbersome.

Certain fundamental requirements should be considered, however, in all estimate blanks. Each should be designed to cover as far as possible every detail which might be required. Nothing should be left to memory.

Every kind of material used, or likely to be used, should be designated. The order in which they appear should coincide closely with the probable order in which

they will be applied in production. Columns or spaces should be provided for quantities and prices. Descriptions should be as complete as necessary for the proper requisitioning of materials from the stock room of purchasing department.

Provision must be made for the extension into columns for totaling all of the items of expense. If the stock room expenses are not covered in the price of articles, provision must be made for it to be included in an equitable manner.

Under the "Operations" heading should be listed every operation for which provision has been made in equipping the plant. Wherever classifications have been made because of the time requirements due to dimensions or other causes, provision should be made for indicating the classification considered by the estimator.

Carelessness and haste should never be tolerated in the making of estimates, yet there is no part of the paper box business that is less carefully accomplished and checked today than the vital pricemaking feature.

In the workrooms foremen are employed to direct the workmen and see that they do their work correctly. Throughout the factory a superintendent serves to see that the product is made according to the specifications, and to coordinate the efforts of the various departments. Salesmen serve as scouts throughout the community, or the country, to get orders on which the factory forces can be employed. If the salesmen, untrained and unchecked, as well as ignorant of the vital factory data, do not themselves make the prices at which the product is sold, the prices are usually made in the office by some one whose authority exceeds his information, without a single test of the accuracy of his work.

The cost system shows instantly, when an order is completed, the amount of the cost of the product. It also shows the amount of the profit or loss, on the order, at the price which was made. It follows therefore that if the estimate blank is designed to correspond in every

essential detail with the cost memorandum, or job record, comparison will be facilitated.

The work of the estimator can and should be checked as closely, if not more closely, than that of any other person in the institution. Even though the manager himself serve in the capacity of estimator, the checking of the estimates should be an important part of a rigid routine.

The fact that in few instances are there any means of checking the efficiency of the management is responsible for the fact that there are so few really competent managers. Authority without responsibility leads to autocracy and inefficiency.

The inefficient manager abhors criticism. His little head is turned by the unmerited authority of his position. He reports to nobody. He endeavors to make up in boastful bluffing what he lacks in efficiency. He derides records, calling them "red tape."

He is the enemy of the cost system, because he is not big enough mentally to grasp its value and to apply the information which it provides. He places self interest and personal pride above the good of the business to which he looks for his bread and butter. The showings of losses prick him like the needles of the cactus prick the desert wayfarer. He hates them. He thinks by stifling them to hide the truth.

He will allow twenty-five per cent of the effort of factory employees to be wasted on unprofitable work through his own mismanagement. But he declines to employ a clerk on records which will yield a large return by showing up and eliminating waste. He dare not face the records of his management,

The efficient manager is never puffed up with the importance of his position. He takes the serious view that authority and responsibility go hand in hand. If he is responsible to nobody else, he is responsible to his own conscience. He must succeed in order to maintain his own self respect. He courts criticism because he knows

that it is only by learning his weaknesses that he can strengthen the weak points. Improvement comes through criticism, never through praise. He compares the records of today with those of yesterday, of this month with last, and with the corresponding month of last year, and of previous years. He must advance, and the rate of advancement must increase. He examines every cost sheet for profit—the life blood of business. If he does not find it in proper degree he compares the estimates with the cost to find the error.

The weakness may be in the estimate. It may be in the factory. It is his business to know where it is and to see that it does not occur again. He makes it his business.

The efficient manager does not risk his business success through dependence upon the partial information which he can get from personal observation at such times as he goes into the factory. He wants definite information. He gets it through a system of factory records which serve him as a hundred eyes in a hundred places could not. The records can be compiled and compared. Present performance can be compared with past performance. Present hour costs and present production costs can be compared with those of last month or last year. There must be gain. Apathy must give way to activity. Industry must succeed indolence. Waste, either in material, time or energy, must not be tolerated.

In designing estimate forms it is better that they include items or operations that are rarely required, rather than that such be omitted. Omissions of items are more frequent than is ordinarily known. The unknown makes little or no impression. In this instance, "what you don't know" doesn't hurt you. It causes a loss where you had a right to expect a profit.

The lists of materials, operations, and other data presented herewith are not offered as forms of estimate sheets. They are merely suggestive of the items which should be included insofar as they are applicable to the

business for which the form is being designed. In no sense are they represented as complete.

A careful survey of the factory should be made in every instance to make sure that no operations are omitted. Merchandise requirements should also be carefully considered lest omissions occur. Nothing is so small as to warrant its being ignored. Carefulness pays.

DATA FOR ESTIMATOR

Date_____

Customer_____ City_____ State_____
Size of Box_____x_____x_____Cover_____Name of Box_____
Size of Packer_____x_____x_____Cover_____Style of Box_____
Size of Tray_____x_____x_____
Size of Frame _____x_____x_____
Size of Extnsn. _____x_____x_____
Height of Neck_____x_____x_____

Materials	Cost	
Box _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Cover _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Ends _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Packer Box ____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Packer Cover __Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Packer Ends___Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Ext. Top _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Ext. Bot. _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Trays _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Neck _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Frame _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Layers _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Block _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Partition _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Easel _____Sheets__No.__Board__x__@ $____Pl. Bk. Pt.__	____	__
Lining _____No. of Sheets____$_____per C_____Bk. Pt.__	____	__
Paper Box_____Color____$____From_____No._____	____	__
Paper Cover ____Color____$____From_____No._____	____	__
Trim Box_____Color____$____From_____No._____	____	__
Trim Cover_____Color____$____From_____No._____	____	__
Tray _____Color____$____From_____No._____	____	__
Bottom _____Color____$____From_____No._____	____	__
Inside Label____Color____$____From_____No._____	____	__
Tops _____Color____$____From_____No._____	____	__
Corners _____Color____$____From_____No._____	____	__

DATA FOR ESTIMATOR—Continued

Materials									Cost	
Extra Strips	Color	$	From			No.				
Blocks	Color	$	From			No.				
Exts. Bottom	Color	$	From			No.				
Exts. Top	Color	$	From			No.				
Seals	Color	$	From			No.				
Hinges	Color	$	From			No.				
Padding	Size	x	Full Sheet		x	$				
Lace	No.		Full Length		x	$				
Ribbon	Color		Width			Length				
Flowers	Foliage		per bunch			Out				
Cloth	Color									
B. B. Cloth	Color			Grade						
Pulls	Kind			Size						
Wood										
Box	Paper		Cloth		Wire		Metal			
Cover	Paper		Cloth		Wire		Metal			
Packer Box	Paper		Cloth		Wire		Metal			
Packer Cover	Paper		Cloth		Wire		Metal			
Tray	Paper		Cloth		Wire		Metal			
Frame	Paper		Cloth		Wire		Metal			
Wrapping	Paper		Sheets			Pounds				
Twine										
Paste										
Glue			Sq. Inches							
				Total Material						

Operations	Hrs.	Cost	
Scoring Box and Cover			
Scoring Packer Box and Cover			
Scoring Tray			
Scoring Frames			
Scoring Necks			
Cutting Ends Boxes			
Cutting Ends Packer			
Cutting Extension Tops			
Cutting Extension Bottoms			
Cutting Necks			
Cutting Frames			
Cutting Padding			
Cutting Cloth			
Cutting Ribbon			

DATA FOR ESTIMATOR—Continued

Operations	Hrs.	Cost	
Cutting Paper			
Corner Cutting Box and Cover			
Corner Cutting Packer Box and Cover			
Corner Cutting Frames			
Corner Cutting Trays			
Die Cutting Box and Cover			
Die Cutting Paper Top and Bottom			
Die Cutting Extension Top and Bottom			
Die Cutting Straps			
Set up Box ____Ends____Stayer____			
Set up Cover ____Ends____Stayer____			
Set up Packer Box ____Ends____Stayer____			
Set up Packer Cover____Ends____Stayer____			
Set up Tray ____Ends____Stayer____			
Set up Frame ____Ends____Stayer____			
Set up Partitions			
Strip Box			
Strip Cover			
Strip Neck			
Strip Frame			
Strip Tray			
Strip Extension Top			
Strip Extension Bottom			
Strip Inside Cover Card			
Strip Drop Front			
Corner Box			
Corner Cover			
Trim Edge of Cover____Color____			
Trim Edge of Box ____Color____			
Top Cover with padding____Sheets of Padding____			
Top Cover no padding			
Bottom Box			
Bottom Tray			
Hinge Cloth ____Paper____			
Glue in Neck			
Glue on Extension Bottom			
Glue on Extension Top			
Glue on Top Card			
Glue on Flower and Foliage			
Ribbon Tie and Fasten			
Lace			
Ribbon or Tape to hold Cover___Length____Width____			
Ribbon on Tray ____Length____Width____			

DATA FOR ESTIMATOR—Continued

Operations	Hrs.	Cost
Doming and Embossing		
Sawing Wood		
Sawing Partitions		
Nest Partitions, Trays, Frames or Layers		
Lining inside of Box		
Lining inside of Cover		
Close		
Nest in Packer and close Packer		
Pack in Cases		
Wrapping ____in a package		
Hauling		
Total Making Expense		
Total Material Expense		
Royalties and Mach. Rentals		
Litho Tops		
Wood Cases		
Storage		
Selling Expense (when not otherwise included)		
Total Cost		
Selling Price		

Remarks:

No fixed rule can be advocated for the paper box industry in regard to whether the rates used should show the total hour cost, including the wages of the operators; or the cost of the operation hour exclusive of wages.

The author believes that the best results will be obtained if the total hour cost is used in making estimates. But in cases where labor is paid on a piecework basis it will probably be best to compile cost figures at rates which do not include the wages, adding the wages as a separate item.

A capable engineer should be able, after a discussion of this point with the management, to arrange the forms

for either method, or for the making of estimates at total hour rates, and determining of cost at hour cost rates exclusive of wages, plus piecework wages.

As between the two methods of figuring, there is no difference in final results. The total hour cost plan will show the cost of the order based upon the average cost rate. The composite plan in which the hour cost without wages is used for time and piecework wages added as a separate item will show the variation between the cost of the work as performed by employees of different degrees of efficiency. If this is not desirable, the simpler plan is best.

In any factory where time work prevails, the total hour cost rate should be used exclusively, for both estimating and cost calculations.

Piecework wages have no relation to any other expense of manufacture. Those manufacturers using the piecework wages as a basis for charging the "overhead" expenses of the factory, because it is easier, are paying a big price to avoid the necessity of learning and the effort of calculating by more accurate and practical methods.

No rule has as yet been given for including the expenses in connection with the carrying of materials. This expense must always be considered separately from the cost of operating the manufacturing processes. Two methods are used, either of which is practical only under certain conditions.

A part of the expenses of materials are related directly to value, i. e., insurance, interest, taxes and shrinkage. Other expenses have a definite relation to weight and bulk, as freight, cartage, porterage, rent of space, etc.

With any plan of calculation we must always balance the cost of the effort against the value of the result to determine whether it will prove profitable to make the attempt. Such consideration leads us to believe that it will not be advisable to use two separate rates on the merchandise element, one by percentage on cost to cover

the expenses related to value, and the other by the pound to provide for the expenses related to weight.

If the concern makes plain boxes as the bulk of its product, it follows that box board is the chief material used. The cost of maintaining the stockroom can be rated on the ton of board with a reasonable degree of accuracy. If on the other hand fancy boxes are made exclusively, and the investment in materials is the prime factor, the value of the material may be used.

The cost of shipping room expense and delivery to either a local consumer, or a local freight house, can usually be carried at a tonnage rate on the board, especially in the type of product wherein material expenses are fairly chargeable by the ton. For freight shipments, both the cost of packing cases and the freight charges, if prepaid, are chargeable directly to the order.

Careful consideration should be given to these points. Snap judgment is attended with risk of loss.

In the Addenda of this book will be found a large number of tables and other data of great value to the estimator. It will pay the reader whose duties include the making of estimates to familiarize himself with the scope of this data. He may use it as a means both of saving time and avoiding the mistakes incidental to hurried calculations.

There will also be found a schedule of the operations of the paper box industry as reported by concerns using Cost Engineering Systems, with the cost per hour of each, based upon the average of conditions within the plants furnishing the data.

The fairest possible average has been produced by combining all of the expenses on any given operation, and dividing by the total hours produced within the period covered by the expenses.

The author suggests that the reader get some practical first-hand experience in making estimates on the time basis, using the production rates and the cost rates given. Comparisons of the results of such estimates with

the results of the percentage methods in common use will prove interesting. They will also show what changes are likely to occur with the introduction of the more modern and scientific method into the reader's factory.

But the reader is warned that the costs as shown in the composite average may differ greatly from the actual costs in his own factory. He should not assume that the production rates and costs can be used in his own case without careful consideration of all the facts.

In any event those who are using a percentage on labor at present will not be likely to make matters worse by using the rates. Percentage methods are so notoriously unreliable that no confidence can be placed in them.

CHAPTER THIRTEEN

Selling Prices

Selling Prices of Paramount Importance—The Bugaboo of Fear—The Buyer's Trick—Futility of Efforts to Destroy Competition—Price Agreements—Introspection Overlooked—Cost Efficiency and Management—The Right Price—Basis of Prices in a Seasonal Business—The Fundamentals of Price Making—Natural Price and Cost—Market Price—Supply and Demand—Selling Plows under Free Competition—Effect of Volume of Production on Prices—Prices should Rise and Fall with Costs—Losses by Fire and Failures—The Crime of Selling Below Cost—Composition of Fair Prices.

To the majority of paper box manufacturers the subject of selling prices is of paramount importance.

In the mind of the average producer *higher prices* seems at once the panacea for all his economic ills, and a desideratum approximating the unobtainable, while the fear that his competitor will offer product of equal quality with his own at a lower price is the bugaboo that persists in causing sleepless nights and fills his days with misgivings for the future.

A large percentage of buyers, realizing the psychology of the situation, play upon his fears, and whether they are warranted by facts or not, repeatedly tell him that his prices are high above all competitors.

Sometimes, in desperation, he tries to destroy the business of his competitor by quoting ruinous prices, believing himself capable of standing the strain longer than his rival.

If he succeeds, it is only to see the competitor's plant taken over by another of lesser experience, who, misplacing the blame for failure, accepts the profitless prices of the foolish manufacturer as his guide in selling.

Realizing the futility of trying to get prices up by fighting his competitors he swings to the other extreme and endeavors to gain his end through price agreements. He

meets them in conferences and soon learns that each is burdened with the same fears, each facing the same problems.

To all of them the subject of "Selling Prices" looms large, overshadowing all other apparent causes of woe. Questions of Cost, Efficiency and Management seem minor items to their distorted vision.

They believe that if they could only compel the buyers to pay more or go without the boxes, the problem would be solved.

Introspection is so rare a quality that perhaps not one in a thousand thinks to look into his own mind for a part of his trouble, and into his business methods for the rest of it.

In every group of manufacturers there are always a few who are more successful than the average, just as in every group there are some who are less prosperous than the average.

The man who blames his competitors for his troubles seldom looks at anything except the selling prices, and, ridiculous though it seems to the outsider, the more prosperous a competitor is the more certain the critic becomes that he is a price cutter.

It is not impossible that the successful paper box manufacturer may make prices lower than his unsuccessful rival, and yet be prosperous, but if he does, it is certain that the cause of prosperity lies in something besides the comparative selling prices.

The facts of Cost, Efficiency and Management are not less important than the prices that are made. One manufacturer may get a relatively high price, and lose money, while another may sell the same boxes at a lower price and make a very satisfactory profit.

The profitableness of a transaction, or a business depends upon the relation of expenditures to receipts, not upon the relation of the estimate (guess) of one manu-

facturer as compared to that of another, as to what product should be sold for.

The prime factor in making prices is the Cost. Cost is vitally affected by the factors of Efficiency and Management.

Price agreements cannot possibly prove effective in solving economic problems or in the creation of profits, because they cannot reach or influence the factors of Cost, Efficiency and Management.

Price agreements are illegal, and rightly so. Price agreements if permitted would breed careless business methods and encourage dishonesty, so that the resultant state of affairs would be worse than at present.

The right price for any item of product is one that not only covers all of the expenses of production but includes a reasonable reward for the producer in the form of a margin of profit, and takes into consideration the range of fluctuation in expenses and conditions incident to the business.

While all selling prices, to be fair, should have as their basis the cost of production, such cost is not necessarily the immediate expenses of such production.

In a seasonal business, such as the paper box industry, the basis of the selling price should be the average cost. The average cost must be determined by the inclusion within the data of every expense item required by a definite class of units during a period of such length as will include the full range of variableness of the conditions of production. The total of the expenses is then divided by the number of such units produced in a coincident period.

Even when correctly determined the cost of production developed in one factory can be compared with that of another factory only by consideration of all of the factors including those of efficiency and management.

This subject is as old as trade, yet because the commercial world has not accepted and agreed upon its principles, it is always a live topic for discussion.

The fundamentals were clearly set forth in a work entitled "The Wealth of the Nations," by Adam Smith, published in 1776. Some extracts from his work with very enlightening comments are included in a recent book, "The New Competition," by Arthur Jerome Eddy.

The following quotations are taken from Mr. Eddy's book, and are worthy of careful study:

"What is a fair price?

" 'Cost plus a reasonable profit,' the seller will answer.

"But the average buyer will quickly reply, 'I do not care anything about your cost or your profit, the only price that interests me is the market price—the price I have to pay.'

" 'But,' the seller urges, 'the market price may be either far above or below a fair price, it may yield me an exorbitant profit, or it may mean a disastrous loss.'

" 'I can't help that.'

" 'Yes, you can, to some extent; if buyers will only cooperate with sellers to control as far as possible the violent fluctuations that are bad for both.'

"And the practical question is, to what extent can that be done?

"A great many writers have dealt with the subject of price, but all that has been written on the theoretical side since the days of Adam Smith has been but little more than refinements upon the conclusions reached by him in Book I of his famous work.

"*Natural Price and Cost*—'There is in every society or neighborhood an ordinary or average rate, both of wages and profit in every department * * * There is likewise in every society or neighborhood an ordinary or

average rate of rent. * * * These ordinary or average rates may be called the natural rates of wages, profit and rent, at the time and place in which they may commonly prevail.

" 'When the price of any commodity is neither more nor less than what is sufficient to pay the rent of the land, the wages of the labor, and the profits of the stock employed in raising, preparing and bringing it to market, according to those natural rates, the commodity was then sold for what may be called the *natural price.* The commodity is then sold for precisely what it is worth, or for what it costs the person who brought it to market, for though in common language what is called the prime cost of any commodity does not comprehend the profit of the person who is to sell it again, yet if he sells it at a price which does not allow him the ordinary rate of profit in the neighborhood he is evidently a loser by the trade; since by employing his stock (capital) in some other way he might have made that profit.

"*Market Price*—'The actual price at which any commodity is commonly sold is called the *market price.*

" 'The market price of every particular commodity is regulated by the proportion between the quantity which is actually brought to market, and the demand of those who are willing to pay the natural price of the commodity, or the whole value of the rent, labor, and profit, which must be paid in order to bring it thither. Such people may be called the effectual demanders, and their demand the *effective demand;* since it may be sufficient to effectuate the bringing of the commodity to market. It is different from the absolute demand. A very poor man may be said in some sense to have a demand for a coach and six; he might like to have it, but his demand is not effectual demand.

"*Supply and Demand*—'When the supply of any commodity falls short of the effectual demand' some will be willing to give more than the natural price and 'a com-

petition will immediately begin among them, and the market price will rise more or less above the natural price, according as either the greatness of the deficiency, or the wealth and wanton luxury of the competitors happens to animate more or less the eagerness of the competition.

"'When the quantity brought to market exceeds the effectual demand, it cannot be all sold to those who are willing to pay the whole value of the rent, wages and profit, which must be paid in order to bring it thither. Some part must be sold to those who are willing to pay less, and the low price which they give for it must reduce the price of the whole. The market price will sink more or less below the natural price, according as the greatness of the excess increases more or less the competition of the sellers, or according as it happens to be more or less important to them to get immediately rid of the commodity. The same excess in the importation of perishable, will occasion a much greater competition to get rid of, than in that of durable commodities.

"'When the quantity brought to market is just sufficient to supply the effectual demand and no more, the market price naturally comes to be either exactly, or as nearly as can be judged of the same with the natural price.

"'The *natural price*, therefore, is, as it were, *the central price*, to which the prices of all commodities are continually gravitating. Different accidents may sometimes keep them suspended a good deal above it, and sometimes force them down even somewhat below it. But whatever may be the obstacles which hinder them from settling in this center of repose and its continuance, they are eventually tending toward it.' (The italic and words in parenthesis are Mr. Eddy's.)

"Adam Smith's definition of a *fair* or "natural" price is as good as any that can be found in so many words, but while the paragraphs referred to seem to lead to definite conclusions because they are precise in terms, careful analysis shows they are little more than graphic descrip-

tions of what takes place under the eyes of every housewife who buys of her grocer. She pays the price asked for the things she wants; whether that price covers cost or not she does not know or care, all she knows is that if she sells eggs she receives what she thinks is the highest market price, if she buys butter she pays what she thinks is the lowest market price—she may find out too late that prices vary considerably in the next street, or that a neighbor the same day received more for her eggs and paid less for her butter.

"The 'Wealth of Nations' was published in 1776. Let us skip a century and a quarter and see what, if any, advance has been made over Adam Smith's propositions.

"A recent writer," President Hadley of Yale, sums up the law of supply and demand as follows:

" '1. As the price of an article increases, the quantity demanded tends to diminish and the quantity offered tends to decrease. There will thus in ordinary cases be a certain price which 'clears the market' and makes the two equal.

" '2. This price will, theoretically, be reached by competition. For so long as the supply is in excess of the demand, sellers will be in danger of having unsold goods left on their hands and will compete to bring prices down; but if the demand is in excess of the supply, buyers will be in danger of having wants unsatisfied, and thus competition will force prices up, thus producing an equation of the supply and demand.

" '3. The prices thus fixed tend to be proportional to the expense of producing the several articles in the market. For if the market price of one article offers a higher rate of profit than the market price of another, investors will gradually abandon the production of unprofitable goods, and put their capital into the line which promises the higher rate, thus increasing the supply and diminishing the price at which it can be sold.

"'4. The equation of supply and demand is thus a double process. First, a temporary adjustment of the demand to the supply by the commercial competition of merchants, which lowers (or, in the converse case, raises) the price until it corresponds to the marginal utility, i. e., until it becomes just worth while for customers to take the whole supply at the price in question. Then there is a more permanent though less accurate and universal adjustment of the supply to the demand, by the individual competition of investors, which lowers, or raises, the price until it becomes proportionate to the marginal expense of production, i. e., until it becomes just worth while for producers to meet the whole demand at the price in question.

"'This is the theory of supply and demand as developed by the English economists from Smith to Cairnes.'

"From the foregoing summary of the work of a century and a quarter it is plain the theory of supply and demand and of a price has not advanced a hair's breadth beyond that formulated by Adam Smith; subsequent writers have simply rung the changes on the theme furnished; his comparatively simple propositions have been almost lost in a wealth of ingenious refinement. He was content to describe things as he saw them and formulate certain general propositions; his successors, most of them, have retired from the market place, from actual observation of daily happenings, and in the seclusion of the closet attempted to reduce his generalizations to mathematical propositions and give them a semblance of laws.

* * * * * *

"When Adam Smith said, 'It is to the interest of all those who employ their land, labor, or stock, in bringing any commodity to market, but (that) the quantity never should exceed the effectual demand; and *it is to the interest* of all other people, that it never should fall short of that demand,' he was very close to the *human*, the *vital* side of the problem he was discussing but he did not follow

the matter further, and from his day to *this* scarcely an economist has devoted time and thought to the really great problem of *intelligent control* of so called 'economic laws.'

"If it is *to the interest* of the community that supply and demand should be maintained as nearly as possible in a state of equilibrium, then it should be *the business* of the community to devise ways and means for controlling the violent fluctuations due to free competition.

"In every country town the prices of small products of the farm are the result of 'free competition.' When the weather is fair farmers 'come to town' in such large numbers and bring so much to market the prices drop to absurdly low figures; when the weather is bad little is brought in and prices go up to absurdly high figures. One year there is a shortage of crops and prices soar, the next, under the incentive of the high prices of the year before a large acreage is planted, the season is good, crops are abundant, and prices drop to a level that yields many farmers less than cost.

"What are farmers doing to help these conditions? Are they meekly submitting to the 'law' of supply and demand? Are they content with the doctrine of 'free competition?' Not at all; they read and are guided by government crop reports; they are forming cooperative societies to control competition, to introduce rational and scientific supervision over both production and marketing to the end that prices may be more sable and returns more constant.

" 'Market price' is a statistical proposition, it has no real, no tangible existence aside from tables of averages.

"What an article sells for is *its* price, whether it is the market price for similar articles depends upon an average struck from a number of sales.

"Tables of averages and variations are of value; they furnish data not only for conducting business, but for controlling competition. They should be compiled for every industry and every locality, and carefully studied. To a

certain extent the government does this, but on so large a scale the figures, when published, are of little real assistance to the individual farmer and manufacturer, they do not help him to make up his mind what he should do next week, next month.

"The prevailing price for certain plows may be $20.00.

"Three makers supply the market, and the plows they make are so alike it is immaterial to users which they buy.

"Each plow costs A, a newcomer, with his smallest plant, $20.00 to make; B, with a larger output, $19.00; C, with a very large output, $18.00—what is the fair price for those plows?

"At $20.00 it is but a question of time when A will go out of business; B is making only fair returns on his investment; C with his larger output is making large profits.

"If A goes out of business the price of plows will advance materially; if he is to remain in business they *must* advance.

"Under free competition A hovers on the edge of bankruptcy; if he closes down temporarily, plows advance to $21.00 and he immediately starts up, when the price drops again to $20.00. He is on the ragged edge of industrial starvation.

"This is no fanciful illustration. It is the normal condition of the industrial and commercial world; it is the condition described by Smith; it is the 'margin of cultivation' of Ricardo and writers upon agriculture and rents; it is recognized in the phrases 'marginal increment,' 'marginal utility,' etc.

"Under free competition fluctuations in supply and demand are sudden and wide, as the most cursory study of price charts demonstrates.

"The inevitable result is that the margin of instability in every occupation and industry is very wide, wide in direct proportion to the freedom of the competition, narrow where competition is controlled.

"The practical question for the community to consider is whether it is better to broaden this margin of instability—of loss and disaster—by encouraging still greater freedom and recklessness of competition, or narrow the margin of instability by controlling competition.

"Is it to the interest of the community that plows should be sold at $20.00 until A is ruined and then go to $22.00 or $24.00, where possibly they were before A started in; or is it not to the interest of the community to pay $21.00 and keep all three makers in business?

"The merchant must provide floor-space, goods, salesmen, delivery wagons sufficient to take care of his customers during 'rush' hours and busy seasons, otherwise he loses trade.

"The manufacturer must provide plant and facilities to meet the demands of his trade during perhaps three busy months of the year, and one good year out of three or four.

"What is the inevitable result of the tendency in every industry to expand to meet the requirements of 'boom' times?

"In all years except those of maximum demand, capacity so far outruns the market that fifty or seventy-five per cent is idle.

"Nothing is more common than to hear the complaint mournfully reiterated by intelligent manufacturers.

"The trouble is there is too much capacity, too many mills.

"Yes, but when the peak load comes every mill works night and day and the same men spend millions in additions, only to shut down in a few months and relapse into the chronic condition of over-capacity.

"If the demand for manufactured goods were constant from year to year, there would be no need for overcapacity, but as the demand is not constant in any in-

dustry the over-capacity necessary to meet the peak-load is a *normal condition.*

"Railroads must have tracks, cars and equipment to take care of 'bumper crops;' if they fail farmers make their complaints heard in legislatures and by railroad commissions—laws are passed, fines imposed.

"Iron and steel companies must maintain hundreds of millions in idle furnaces and mills, waiting for the 'boom' that is years in coming; if they do not, and prices soar as the result of unexpected demand, the consumer complains and makes his complaints heard in the press and before investigating committees.

"So wasteful and improvident is the economic organization of modern society that to meet its demands, to carry its peak loads—many due largely to whims and unrestrained impulses—a large percentage of the capital and labor in every industry, practically every occupation, must be maintained in idleness from a quarter to three fourths of the time. And so indifferent is society to its moral and econimic obligations during these periods that it sees capital rust and labor starve with callous indifference, complaining bitterly if both are not ready to respond when the stress comes, when the community experiences what is fundamentally a psychological condition—the 'buying fever.'

"Generally speaking prices of farm products rise and fall with cost, while prices of manufactured goods rise and fall *inversely* to cost.

"The one is a *normal and sound* response to conditions, the other is an *abnormal and unsound* response.

"If crops are short the cost per unit—per bushel—is high and, other things being equal, *prices* are *high;* and *vice versa* if crops are abundant.

"If the output of manufactured goods is low, cost per unit is *high,* but prices are *low,* and when the output of goods at the maximum cost is *low* and prices are *high.*

"To verify these propositions by appeal to statistics would involve an exhaustive analysis of market conditions throughout the world, for prices of staple agricultural products in a given country are affected not only by the output of the country but by the crops and market conditions in all other countries; but every farmer and every manufacturer knows the truth without going beyond their own personal observations.

"The farmer knows that if on the same acreage and with the same labor he produces but two bushels of wheat where the year before he produced three, his cost per bushel is higher, and if farmers throughout the country have had no better success, the price of wheat will be higher, how much higher will depend a good deal upon crops in other countries.

"*Per contra* if the same acreage and labor yield five bushels as against three the year before, the cost per bushel is lower, and, other things being equal, the price will be lower.

"The manufacturer faces the exact reverse of these conditions; his prices move inversely to his costs.

"It being conceded that a fair price should cover legitimate cost plus at least some profit, it follows that *prices should vary with cost and thus ordinarily be higher when the output is low and vice versa.*

"But—as noted by Adam Smith—the *exact reverse* obtains. As demand falls and output is curtailed prices invariably fall.

"The condition is a curious illustration of the tendency of men to accept as right and natural any evil, however great, if it is of long duration.

"That prices should drop as cost advances and rise as cost drops is a *fundamentally unsound condition,* yet because such has been the result of the old unrestricted competition from time immemorial, the very people who suffer most, employers and employees, tamely acquiesce.

"If the community were organized on a socialistic basis, *prices would rise and fall with cost;* the state would not commit the folly of selling goods cheaper and cheaper as they cost more and more, nor would the people permit the state to charge higher and higher prices as costs dropped lower and lower.

"In cities that make any pretense of managing their gas or water plants on a business-like basis, charges for gas and water rise and fall with cost of the service; in the best municipal plants this is the case, and *in no municipal plant are prices advanced as consumption increases and costs drop.*

"Why should not the same rule obtain in private enterprise? Why should not men be encouraged to cooperate to control the ancient 'law' of supply and demand, and keep prices as constant with relation to cost as cities try to do in their industries?

"It will not be long before the country will recognize its obligations, economic and moral, to men—employers and laborers—who in response to the needs and desires of the country *hold themselves and all they have* in readiness to supply the maximum demand, the peak load. The country will not only permit them to, but will insist they shall get at all times fair prices for products and services, and fair prices mean prices which cover all risks and losses incidental to the enterprise through both good times and bad.

"If, by way of illustration, an association of manufacturers of staple goods steadily advance prices as output fell off and costs advanced, how long would it be before buying would begin again?

"It may sound paradoxical to say buying would be stimulated by advancing prices, but it always is under normal conditions; it is human nature for a man to buy when he *sees* prices are going up and *thinks* they are going up higher; it is also human nature to stop buying when he *sees* prices dropping and *thinks* they are going lower.

"There is, of course, always a point at each extreme where the tide turns, but, generally speaking, there is nothing so stimulating to buying as a rising market, nothing so discouraging to buying as a falling market.

"In fact, the rising market is largely due to the stimulated buying, and the falling market is largely due to the holding back of buyers, each waiting until he thinks the bottom is reached.

"The arbitrary adjustment of prices to cover costs would do more than any other one expedient to stabilize prices and keep the market at a constant level.

"With prices adjusted to costs, buyers would *know* that every decrease in demand would mean higher costs and *higher prices*—hence, there would be no object in holding off; on the contrary, there would be every incentive to buy and restore the equilibrium.

"*Business will not be on a sound economic basis until prices rise and fall with costs.*

"The word '*fair*' in connection with prices lacks virility; it not only admits but invites debate; it suggests possibilities of variations.

"A *fair* price is a *right* price, and the *right* price depends upon conditions that are susceptible to scientific investigation.

"*Price* is fundamentally a *scientific proposition.*

"The scientific side of cost has long been recognized. Men are being taught slowly but surely that cost is not the haphazard proposition our fathers supposed it was, a mere matter of adding together all of the outlays and calling the total 'cost.' The problem of cost is receiving profound consideration, and its difficulties are beginning to be appreciated. * * *

"As the problem of cost, which is of first and fundamental importance, is worked out, the question of price naturally follows.

"Whether a man shall be permitted to add little or much to his cost by way of profit, one thing is certain, *the right price never falls below cost.*

"The community has a direct and vital interest in maintaining prices above cost.

"When a man is detected selling goods below cost his conduct should be as promptly and rigidly investigated as if he were detected in secreting goods to defraud his creditors—the offenses are akin.

"When a merchant, a manufacturer, or a farmer fails the public looks upon his misfortune as his own, and passes on.

"This indifference of the community to the prosperity of its units is a curious phenomenon, for one would think that the whole would realize its welfare depends upon the welfare of its parts, and every unit which fails to support itself is a burden upon the other units and a debit against the resources of all.

"The man who watches his neighbor's house burn and congratulates himself that his own has escaped, seldom stops to think that, while the loss falls in the first instance on his neighbor, secondly on the insurance companies, if there be insurance, the real loser is the community; if there is insurance the loss will be distributed in its rates, but whether distributed or not the country is out just that much useful property, property into which the time and labor of the community went.

"The losses due to wasteful and ruinous competition, to foolish and reckless investments, to selling below cost, are all borne by the community the same as losses by fire.

"In 1910 $214,000,000 worth of property was destroyed by fire in the United States. In the same year there were failures with liabilities amounting to over $201,000,000. The assets probably did not realize more than a small percentage of that gross amount.

"On the face of the reports it appears that the losses due to wasteful business methods almost equal losses due fires; as a matter of fact they are far greater, for of the men who lose in business, and who are driven out by competition, comparatively few publicly acknowledge their failures and plead bankruptcy. By far the larger number manage to pay their debts and retire quietly, but because they 'pocket the losses' and say nothing the effect upon the wealth of the community is not changed.

"The peddler who buys a clock for $10.00 and at the end of the week sells it for what he paid for it, is out a week's time and his support for that period, and the community is out the same.

"When a man inherits $100,000 and invests it in a farm or manufacturing business he invests what is nominally and legally his, but what is in reality part of the accumulated capital of the community, capital created by the preceding generation; if he loses it all he is no poorer than he was when he inherited it, but the community is poorer by the hundred thousand plus the waste of time and plus, *what is the greater consideration,* losses due to the demoralization of the particular business caused by the ignorant and inefficient efforts of the man who failed.

"In a sentimental way the interest of the community in the welfare of its citizens is recognized and asserted oratorically and rhetorically, but the time is speedily coming when this interest will be asserted practically. For a long time the community has maintained expensive fire departments to prevent and minimize losses by fire; in time it will see the wisdom of maintaining departments to prevent or minimize losses by failures. As it is now this country does its best to aggravate the conditions that produce failures; laws are framed that forbid men doing the things that prevent failures; recklessness, wastefulness, inefficiency in business are encouraged, and when failure results, as result it must, an easy way of escape from individual responsibility is provided by the bankruptcy law, which says to the man who has lost his own

and his creditors' money and who, by his reckless methods has caused far greater loss to men trying to do business on a sound basis, 'You need not pay your debts, you are free to find other creditors and start in all over, to fail again—and as often as you please.'

"The time will come when the community will take at least as much care to prevent failures as fires, and when a failure does come it will sift to the bottom the question of responsibility.

"It may yet be made a crime to sell goods below cost.

"Every man knows that if a clerk in a shop wilfully destroys some of the goods he is liable to his employer for the full value.

"If the clerk gives away goods he is also liable for the value. If he sells them at a price less than that fixed by the employer, he is liable for the difference.

"If the clerk is told the cost, and told to get the best price he can over the cost, and he sells below cost, he is liable for the difference.

"The average clerk in a country store, who has never studied law, knows all these things—self-evident propositions of common sense and honesty.

"It is not so commonly realized by officers of large corporations that the same propositions apply to them. The very magnitude of their transactions tends to make them feel they can do as they please with the products of their company.

"Hence it is a common thing to hear officers of corporations say they are taking business below cost.

"This may be necessary at times and under exceptional conditions, but the officer of a company who knowingly sells its products at less than cost runs the risk of a suit on behalf of the stockholders, and in such a suit he would be obliged to convince a court that each sale below cost was for the benefit of the company, and if the court

should think otherwise he would have to make good the difference.

"Under existing *unscientific* and vicious competitive conditions it may *seem* necessary to sell goods below cost at periods, or in localities, or to particular parties; and so confused are our notions regarding what is *right* in commercial conduct that it is probable most courts would decide in favor of officials who answered that they were obliged to sell below cost because others were doing the same thing—*to meet competition;* that is the principal excuse offered for all tricky, vicious, wasteful things done in business, 'I am doing only what others are doing.'

"That excuse will not hold forever; it is losing force rapidly.

"Any day a wise court, in a suit in behalf of stockholders against officials for selling below cost and causing a large loss may say, 'Because officers of other companies were doing the same thing is no excuse for you;' you cannot even introduce evidence to show that others did the same thing; the only question before the court is whether there was anything *in the condition of your own company* which made it *necessary* to dispose of its assets at a large loss; it is no answer for you to say that you wished to hold the trade, extend trade, or do something else to your competitors; only the *stockholders,* the *owners* have the right to say whether they wish to *lose* money doing the things that you wished to do; as agents and employees, it is your duty first of all to conserve the assets of the company and not *give* them away in pursuance of a competitive policy *you* happen to think good because aggressive.

"If these notions were lodged in the minds of all representatives and officials, the *seeming need* for selling below cost, as a *competitive device,* would disappear, because they would be afraid to yield to it, and because they would see that in the long run *it does not pay.*"*

*For Mr. Eddy's suggested remedy for the evils of "free competition" the reader is referred to his book, "The New Competition."

The foregoing quotations, including as they do the opinions of such eminent authorities as Adam Smith, President Hadley, and Arthur Jerome Eddy, fully agree with the contention presented by the author that a definite knowledge of the cost of production is of vital and prime importance.

Selling prices cannot be intelligently made without definite knowledge of cost, and the recognition and consideration of part of the expenses as a basis of cost will not serve. Cost must be determined by consideration of all of the factors or elements in relation to the volume of business, and its seasonal nature.

The day of haphazard and makeshift methods has passed. The manufacturer who wishes to stay in business must fix his prices upon provable facts, otherwise he is not deserving of the confidence of his customers or of the community.

Selling prices are fairest when they include not only a reasonable profit above cost of manufacture, but the elements of Efficiency of production and Management which assure the buyer that the cost has not been inflated through careless or extravagant business methods.

CHAPTER FOURTEEN

Figuring Percentages and Profits

Nine Out of Ten Business Men Do Not Know How to Figure Profits Correctly—School Textbooks Teach Wrong Methods—How Ignorance Cost Contractor $7,500 per Year—Example of Methods for Merchandising—How a Paper Box Factory Management Fooled Itself—Using Profit on Sales of Material to Operate a Losing Factory—Setting Long Price to Permit Several Discounts —Rule for Figuring Profits—Examples of Incorrect Rules in School Arithmetics—Losing Money While Figuring to Make Profit —Comparative Rules for Figuring Expenses, Interest, Dividends, and Profits.

Nine students out of ten leave school without a practical understanding of percentages, and how to figure profits.

The fact that textbook writers, school teachers, and most business colleges, fail to realize the needs of modern business, and blindly follow traditions, is responsible for much of the financial trouble in the commercial world.

In conventions of merchants or manufacturers, which have convened for the purpose of studying better business methods, the author has frequently offered the simplest problems in profit-figuring, supplied cards for the calculations, and asked for unsigned examples of the methods of determining selling prices which, under certain circumstances, would yield a specified rate of profit. In no case have more than ten per cent of the replies been correct. The most common type of calculation results in a loss of more than half of the specified rate of profit.

Few people understand that when they add a certain percentage to an amount, and later deduct the same percentage, a deficit occurs.

Many concerns lose thousands of dollars through "long price lists." The employees to whom were given the work of preparing the price lists did not understand how to figure percentages.

The reader is requested to analyze carefully the illus-

trations, which follow, to learn the rules which are given in this connection that he may avoid the losses sure to occur if they are disregarded.

Illustration No. 1:

A building contractor, doing a business of about $750,000 per year, made all of his contracts by agreements wherein it was specified that the client was to pay all bills for material and labor, as presented, with the O. K. of the contractor. The contractor was to furnish the plans, secure the workmen, supervise the construction, and keep the records for a certain percentage (say 10 per cent) of the total cost of the building.

He had been in business on this basis for seven years. His custom was to take the total amount of the bills for material and labor, divide same by ten, and present his claim for the 10 per cent.

Several of his clients suggested that he was not getting 10 per cent of the total cost which, of course, included his fees. In a vague way he realized that this was true, yet, rather than admit that he did not know how to determine the proper amount, he continued to accept ten per cent of the face of the bills paid.

In a case where the amount of the bills for material and labor was $4,500, this contractor received as his share $450. Had he learned that in any transaction of this kind the total is represented by 100 per cent, and that he could find the total by dividing the amount of the bills by the percentage which they represent (100 less the percentage due him, in this case 90), he would have found that the total was $5,000, and his share $500 instead of $450.

His losses the preceding year, because he was not properly taught in school, and was too proud to admit his ignorance afterwards, amounted to one per cent on more than $750,000, or upward of $7,500.

According to his theory and estimates, he should have had a nice income after paying his draftsmen and clerks, but his actual experience was disappointing.

Many manufacturers, during times of uncertainty in cost of material and labor, take contracts on a basis of cost plus a percentage of profit. Not realizing that the basis of profit is always the selling price, and never the cost, these manufacturers add to the cost, a percentage of cost, thereby cheating themselves out of part of their profits.

Illustration No. 2:

The author has in mind a business where all sales are made on commission; direct advertising being the only other item of expense incurred to secure business. The percentage of commission and the appropriation for advertising, which also is a percentage of the sales, together amount to 20 per cent of the business done. A profit of 10 per cent is considered satisfactory in this business.

As an example of correct methods of figuring the selling prices of orders in which goods are made to order we will take a case wherein the estimated cost, exclusive of advertising and selling expenses, is $610. It is desired to know what price to make on the order to cover advertising and selling, and also yield 10 per cent profit.

Advertising, selling expense, and profit, are known percentages, all having the same basis—selling price. The total is 39 per cent of the selling price. Neither amount, the commission, the advertising allowance, the profit, nor the selling price is known.

The first three, being percentages of the fourth, cannot be known until selling price is determined. All that is known is the estimated cost and the percentages of the selling price which are represented by advertising, selling and profit. These altogether equal 39 per cent. The selling price, being the basis, must be represented by 100 per cent. One hundred per cent less 39 per cent equals 61 per cent, or estimated cost. Now if the latter, $610.00, is divided by 61, the result will be one per cent, or $10.00. Setting the decimal point over two spaces to the right

multiplies the amount by one hundred. Now we have the selling price—$1,000. Ten per cent of this, or $100, is the amount of profit; $290 is the amount allowed for advertising and selling commission.

The method pursued by the majority of business people, and very frequently by accountants, is as follows:

Cost	$610.00
Advertising and Commission 29%	176.90
Total Cost	$786.90
Profit, 10%	78.69
Selling Price	$865.59

The actual payments for commission and advertising appropriation will be 29 per cent of $865.59, or $251.02. This amount deducted from the selling price of $865.59 leaves a remainder of $614.57. No money was lost on the order but the amount of profit was reduced to $4.57. When business is done on that basis it is not surprising that concerns figuring a reasonable profit on their estimates find themselves without tangible profits at the end of the year.

Remember this rule:

In all calculations connected with selling expenses and profits, the selling price is the basis, and is represented by 100%.

Illustration No. 3:

In this illustration we will take the case of a paper box factory where profits and dividends were badly confused. One of the principals in this business had spent a number of years serving as bookkeeper and accountant for another concern which had failed.

The author was told that the concern was the most profitable in the industry, so far as the principals knew. They had a good trade which the two principals had developed through their personal effort to a point where

they had practically no competition with the bulk of their customers.

They boasted a 25 per cent net profit in the preceding year, lately closed. To prove that this was true they stated that they had within the month paid a 25 per cent dividend on their capital stock of $100,000.

Asked how they had done it, the author gathered the following information which is condensed for brevity:

Capital stock, $100,000
Sales, $360,000
Material used, $99,590
Profits, $27,280.

Their plan of making prices was as follows: Calculate the piecework wages on one thousand boxes of the description required; multiply the total by the number of thousands in the order; add 100 per cent for overhead; add the cost of materials; add one-third of the last total for a 25 per cent profit on the sale.

The fact that they were able to pay a 25 per cent dividend satisfied them that they had succeeded in making 25 per cent profit for the year. It had not been noticed that while they had calculated to make 25 per cent on sales they had succeeded in making only 25 per cent on the capitalization. They confused the percentage of dividends on capital with the profits on sales.

When asked if they had included depreciation in their calculations they stated that they had charged off their customary 5 per cent. Interest on investment had not entered into their calculations of cost or income. They admitted the justice of an 8 per cent reserve for replacement, to offset the depreciation on plant. Taking an additional 3 per cent for depreciation, and allowing 6 per cent of total investment as interest expense, their profits dwindled to $18,940, or slightly over 5 per cent of the sales.

It was easily shown that the addition of one-third to

the cost of the $99,590 of materials used should have yielded $33,177 net profit on materials alone. The actual net profit being $18,940, it was evident that the factory had been operated at a loss which had absorbed $14,237 of the profit which should have accrued on the materials.

In this connection remember this rule:

Interest and dividends are always figured on the basis of investment; commissions, selling expenses, and profits, on the basis of sales.

Illustration No. 4:

With the following example the figures have been changed from the actual amounts involved. The simple figures presented will make the illustration easier to understand.

In this instance the manufacturer of an article was anticipating an increase in the cost of raw material, and wished to provide for it in a long price to the consumer, from which the retailer could, for the time being, offer a reduction of 20 per cent, while making a profit of 50 per cent. The jobber was to have 10 per cent, while the manufacturer wanted 33 1-3 per cent profit.

This manufacturer had tried to figure the matter out by taking the cost of the articles (for example $1.50) and adding various percentages. He consulted a certified public accountant who was recognized as the best in the community, but was unable to find the solution of his problem. Every test from the assumed selling prices which were tried worked out a result more or less different from the cost.

When the author was finally consulted the answer to this question was quickly determined by following the rule that the selling price is always represented by 100 per cent, all discounts, commissions, etc., starting from that basis. The method of calculating follows:

Long retail price	100%
Retailer's discount to consumer	20
Retail selling price	80%
Retailer's gross profit 50% of 80%	40
Jobber's price to retailer	40%
Jobber's gross profit, 10% of 40%	4
Manufacturer's price to jobber	36%
Manufacturer's net profit 33 1-3% of 36%	12
Manufacturer's cost	24%

The amount of the long retail price is now determined by dividing the cost ($1.50) by the percentage of the long retail price which it represents (24). The answer is $6.25. This is proven as follows:

Long retail price	$6.25
Retailer's discount to customer 20%	1.25
Retail selling price	$5.00
Retailer's gross profit 50% of $5.00	2.50
Jobber's price to retailer	$2.50
Jobber's gross profit 10% of $2.50	.25
Manufacturer's price to jobber	$2.25
Manufacturer's net profit, 33 1-3% of $2.25	.75
Manufacturer's cost	$1.50

The author has endeavored to make clear to the box manufacturer the necessity, under modern conditions, for the use of the selling price as the basis (100 per cent) for all calculations in connection with expenses of selling, commissions and profits. Using one basis for all, avoids the confusion incident to the difference between the amount of percentage added and the same percentage deducted.

For example:

Taking 100 as the basis; if we add 50 per cent we get a result of 150; if we now deduct 50 per cent we get a remainder of 75.

Taking again as the basis 100; if we deduct 50 per cent we get as a result 50; if we now add 50 per cent we get the result 75.

This confusion has led to the frequent publication of percentages to be added to cost to obtain certain other percentages of profit, viz:

To make a profit of 20 per cent add 25 per cent to cost.

To make a profit of 25 per cent add 33 1-3 per cent to cost.

To make a profit of 33 1-3 per cent add 50 per cent to cost. Etc.

This might be a practical scheme were it not for the fact that percentages do not always occur as fifths, or quarters, or thirds of one hundred. When they run into odd figures it is much more difficult to apply the percentage on the cost, and the probability of misunderstanding and errors is greatly multiplied.

Another complication occurs when two or more percentages occur; as in the case where it is desired to learn at what price an article or order must be sold to cover a certain percentage for handling expense (rent, insurance, etc.) on merchandise or materials, a percentage to cover cost of selling, and another for profit.

Reference to the arithmetics in common use will reveal these inconsistencies and the impracticability of trying to follow their rules in the course of ordinary business.

The following are direct quotations:

"Percentage is a term applied to computations in which 100 is employed as a fixed measure or standard."

Under the subheading "Profit and Loss" these statements are made:

"Profit and Loss are terms used to express the gain or loss in business transactions.

"Gains and losses are usually estimated at a rate per cent on the cost, or the money or capital invested.

"The base is the cost, or capital invested."

Numerous examples are given, showing that the theory is that if a man bought a horse for $100 and sold it for $150 he would make a profit of 50 per cent.

Under the sub-heading "Commission" the same arithmetic presents the following statements:

"Commission is the fee, or compensation, allowed an agent for transacting business and is usually computed at a certain rate per cent of the money involved in the transaction.

"The base is the amount of sales."

Following these statements a number of examples are presented wherein the amount of commissions is shown to be certain percentages of the sales.

Theoretically the plan works out all all right, because all the examples are simple. Each group is placed under the heading of its class. No combinations are presented.

Suppose the farmer who bought the horse did not sell it but engaged an agent to make the sale, at the same price but at a commission percentage lower than the rate of profit he had calculated, say 33 1-3 per cent. What would be the amount of profit remaining to the farmer after the sale and payment of the commission?

The farmer bought the horse for $100, anticipating that he could sell it at a profit of 50 per cent, thereby making a profit of $50. For some reason he decided to engage an agent to make the sale, and thinking to share the profit with the agent he offers him 33 1-3 per cent commission for his effort. The commission, being based upon the amount of the sale, is $50, and the farmer has taken a risk and gained nothing.

Suppose that the farmer had the horse in his stable

for a month at a feeding, or caretaking, cost of $10. He would also have to calculate that as part of the cost.

We now find that the total cost of the horse, including the care, feed, and commission, is $160. The amount received for the horse is $150. The loss on the transaction was $10.

It is hoped that the foregoing examples have made it clear that all items of selling expense, commissions, and profits, should be calculated on the basis of selling price, and not on the cost.

The selling price at which an item will yield a certain rate of profit is easiest found by dividing the cost by the percentage left after deducting the desired profit rate from 100. Thus:

To make 10 per cent, divide total cost by 90.
To make 11 per cent, divide total cost by 89.
To make 12 per cent, divide total cost by 88.
Etc., etc.

When this rule is once absorbed it will not be necessary to keep profit percentage tables handy.

When there are two or more percentages, as handling expense, selling expense, profit, etc., all determined on the basis of sales, they should be added together and the total deducted from 100 to get the divisor. Never use the percentages separately as described in connection with Illustration No. 2.

At the close of a year's business the amount of net profit is compared with the total sales to determine the rate per cent of profit on the business for the year. Within the total are many items, some of which are more or less profitable, while others proved unprofitable. Yet it is customary and practical to mention the net earnings as a flat percentage of the sales.

A business amounting to $100,000 which has proven to have made a net profit of $18,000 would be said to have made 18 per cent. Not 21.95 per cent, as would be the case if the calculation were based on the $82,000

which covered the cost of goods sold, the selling and handling expenses.

If then it is right to consider profits on total sales as a percentage of such total, it is also fair to assume the profit on the individual sales as a percentage of the selling price, and not as a percentage of the cost.

Paper box manufacturers who will familiarize themselves with the rules presented herewith, and use them in their business will find them a valuable means of calculation, and an elimination of the losses commonly caused by confusion of methods.

The paper box manufacturer should understand and recognize that the expenses of manufacture cannot be distributed by percentage, as no basis exists upon which the distribution can be equitably made. The commercial and selling expenses, however, which must be provided for in the margin between making cost and selling price can be distributed by percentage. The method of distribution (on extended values) given in the chapter descriptive of making the summary of costs, conforms fully with the rules given herein in connection with the expenses of merchandising and profits.

The cost of handling merchandise in the form of both raw and finished stocks is covered by the same rule. Make the distinction that merchandise may have to be classified according to its nature and a different percentage applied for handling each classification, just as a separate expense rate must be found in a department store for the expenses of handling various kinds of merchandise.

It will be well now to present collectively the correct rules for the use of percentages in connection with the expenses of the paper box industry:

(*a*) Manufacturing Expenses: On account of the extreme variation in the amounts of various items required by the different processes, no distribution by percentage is possible. Each item must be charged in proportion to its use, or its benefit to the individual process, as ex-

pressed in units by which the item itself, or its use is measured.

(b) Merchandising Expenses: Advertising, selling, commissions, rent of storerooms, and all other expenses in connection with the sale of the manufactured goods, or materials, or articles bought for resale, may be charged by percentage of selling price, it being understood that where the proportions of such expenses differ to any considerable degree on different classes of merchandise, each class shall be charged with such rate as will cause the sales of that class to carry their just proportion of the expenses involved.

(*c*) Interest is always to be considered at a rate per cent per annum of the amount invested.

(*d*) Dividends are to be considered at a rate per cent of capital stock entitled to participate.

(*e*) Profits are always to be considered at a rate per cent of the amount of sales.

CHAPTER FIFTEEN

The Fetish of Uniformity

How Organizations are Misled by Unattainable Ideals—Mistaking Mechanism for Principle—Standardization—Principles and Arbitrary Standards—Standard or Uniform Cost Systems Impractical—Standardized Costs Interesting But Unreliable—Violating the Fundamental of Justice—Relative Value of Uniformity Compared to Accuracy—Resolutions Cannot Change Facts—Principles Only Basis for Permanent Standards.

A great deal has been said and written by prominent persons about the desirability of uniform cost systems and of uniform methods of making estimates. The cause of all of this sincere discussion and earnest effort is the hope, frequently expressed, that sometime there will be uniform prices on a uniform product.

Whole organizations of men, intelligent, wide-awake and commendable, pledge themselves to some scheme for uniformity in their craft. They all realize that the rule-of-thumb practice of setting prices is the cause of most of the difficulties confronting the manufacturer today.

The chief trouble with these gentlemen is that they are all laboring under the same delusion. The delusion of formula. The mistaking of form for essence. The mistaking of mechanism for principle.

Some bodies of manufacturers have convened in a deadly-earnest effort to solve their problems. They actually put themselves on record as believing that accuracy of result was of secondary importance when compared with uniformity of method.

They believed that because some standards have been created by agreement, and made permanent by long usage, they could formulate their desires into resolutions and vote them into practicability, regardless of the fundamentals of the universe.

In fact one organization, several years ago, after an extremely controversial session, in which a bare majority

favored a set or arbitrary rules, had the temerity to publish them, and at this writing, still does publish them at intervals under the caption "Fundamental Principles."

Notwithstanding that the methods advocated violate every fundamental of cost, as well as the fundamental of justice, the effort at standardization which they have made was a laudable one. They were ignorant of correct methods and admitted it. Their chief fault was in making no provision for improving their work and assuming that to correct their error would destroy their standard.

Standardization is one of the most important factors in modern industrial advancement. It enables people engaged in similar lines of effort to "speak the same language," interchange ideas, equipment, and products.

We learn to trust each other through the use of standards. We choose or discard our friends by moral standards. We agree to standards of weight, measure, count, and quality, and judge the honesty of those with whom we have business dealings, by the strictness with which they respect these standards. Toolmakers standardize tools, machine builders standardize machine parts, railroads standardize the gauge of track, cars, equipment, etc.

Many standards are purely a matter of agreement. Others have a fundamental basis which is not subject to change at the whim of men. For example: In the matter of time, the year, the seasons, the lunar month, and the day, are periods over which man has no jurisdiction. The calendar month, the week, the hour as also minutes and seconds, are man-made terms of time measurement. Were men so inclined, they could arrange and agree that the day should consist of a hundred hours, the hour a hundred minutes and the minute a hundred seconds, thereby making these units of time conform to the decimal system of numerical calculation. But what body of men by agreement could affect the length of the solar year, the lunar month, or a day? These are fundamentals as are also the principles of justice and equity, and

the law of compensation upon which the science of cost-finding is constructed.

We hear a great deal about standard costs, and standard cost systems. Few of the people who discuss these matters have troubled themselves to analyze the terms, or even to define them.

As a matter of fact there is no such thing as a standard cost. In the nature of industry there cannot be. Cost is a result of conditions—the sum of expense factors. Unless the expense factors and the conditions are constant there can be no standardized cost.

Standard Cost Systems imply uniformity of cost systems. There can be no uniformity of systems unless there is uniformity in the plants using them. There can be no uniformity of Cost Systems unless the conditions of production are the same.

In one factory the equipment, the class of labor, the personnel of the business organization is selected specifically for the designing, sale and production of high class product; orders for skeleton or other cheap grades of boxes are not considered desirable. In another factory, owing to location within easy access of factories, using cheap boxes exclusively, all facilities are developed with a view to rapid production of that class. In a shoe-making center many factories specialize only on shoe boxes, making large quantities of a limited number of standard sizes, labeling and delivering as the various customers require the product.

One factory makes stiff boxes only, another combines stiff and folding boxes, a third includes tubes and cans. Some may make cigar boxes, jewelry cases, packing cases, or fibre shipping cases. Again others include in their combinations of product such departments as printing, lithographing, photo-engraving, steel and copper-plate engraving and printing.

Average or "standardized" cost developed from data secured in such a variety of plants may be very interest-

ing, but should not be relied upon too fully as a basis for estimating or selling.

Expense factors are influenced by conditions. Cost is the sum of expense factors, therefore cost can be influenced only as conditions can be governed.

After an item of product has been produced, no scheme of figuring can change its cost. No amount of discussion of or agreement between manufacturers as to methods of calculating cost, can have any effect which will increase or decrease the cost.

Once the production is accomplished, the cost, whether known or unknown, is a fact which is incontrovertible, unchangeable and eternal.

The cost of future lots of product can be affected by discussions only when they result in changes of conditions or methods of production.

In the past, accountants have differed widely in their advocacy of methods of applying overhead expense because there were no recognized principles of cost. An accountant would not countenance the charging of an item of merchandise, purchased by or delivered to one customer, to the account of another. Yet, because of his lack of knowledge of the principles of expense, he would without hesitation charge "overhead" in a manufacturing cost system in a manner which will, through its result, make the purchaser of one item of product pay expenses incurred on account of the production of other items, which in turn are received by other purchasers who do not pay enough to cover the cost of production.

This is a clear violation of the fundamental of justice, the law of compensation, and the fundamentals which experience has demonstrated in connection with the distribution of expense.

Such methods do not determine the cost. They simply serve to confuse the ignorant. They are on a par with attempting to postpone the sunset by turning back the hands of the clock in mid-afternoon.

If a thing is not true, nothing that can be said about it, or claimed for it, can make it true.

If a thing is wrong, no agreement between individuals, or organizations, to treat it as though it were right, will make it right.

Humanity demands truth and justice, and will finally accept nothing less.

The plea that uniformity of figuring methods is more important than accuracy may fool the rank and file for a time, but no permanent standards can be built upon such a foundation.

The moment the individual realizes that the standard is unreliable, his confidence is weakened, and its ultimate rejection is only a question of time.

The adoption by any organization of a makeshift, inaccurate, uniform, or standard figuring system, miscalled a "cost system," may seem for a time to serve the purpose for which it is intended. But when its membership realizes its shortcomings the result will be a reaction that will not only create distrust, but is likely to cause the membership to reject in the future all sincere efforts to establish correct methods, thereby destroying the results of the good work already done.

When a theory has been proven incorrect, the logical thing is to acknowledge the fault, find a better way and get it into use as quickly as possible. Trying to make a wrong standard permanent, and to postpone the time when the error must be acknowledged, by repeatedly passing resolutions of commendation, may create an impression of sincerity, but it has no effect upon the facts.

Just as the man who is willing to admit a mistake and try to correct it, is a bigger and better man than he who tries to perpetuate his error by a strong bluff, the organization which seeks the good of its membership, and the confidence of the public, must stand ready to change its standards quickly whenever they are proven wrong, rather than try to shield the authors of error from

the embarrassment which they fear as a result of admitting their fault.

In the realm of the experimental, standards can have no permanence. They are simply the guide posts which mark the limitations of experience at various stages of human advancement. When one standard has been surpassed, it is time to set a higher mark and go onward toward the goal of perfection. We will probably never reach the goal, but that is no excuse for tying to a present standard when we can see a better way beyond.

Human progress has passed the stage where might must be recognized as right. No body of men, however earnest or influential they may be, can either by majority or unanimous vote create accuracy, or permanent standards, through practices which violate a single fundamental principle.

Permanent and practical standards must be based upon provable principles, capable of withstanding the most rigid analysis, thereby gaining strength with experience, rather than destroying the confidence of the user.

The "uniformity" of cost systems, the subject of much discussion, is a "fetish." It is an ideal which like the desire to live forever, may be present in the mind of every individual interested in the subject, yet none can ever really hope to attain it.

The individuality of factories, and the methods pursued within them, are simply the reflection of the minds of those responsible for their operation. As long as men retain the characteristics of their individuality, they will continue to think and act differently from each other. The tools they control, and the things they do, will differ.

No two factories are alike. No two factories can be alike. They might be housed in duplicate buildings. They might be equipped with exactly the same machinery, set in exactly the same positions. They might be established with the same plan of organization, and every position be filled by competent persons, yet within a month the in-

fluence of their personalities would be such that the volume of business would be different; the character of the product would be different. All of these things affect the conditions of production, and the conditions of production affect the cost.

Establish within these factories two cost systems using identical forms, and operate them efficiently. The resultant costs will differ as widely as the conditions of operation differ. Uniformity of systems will last only as long as the uniformity of the factories last. If the systems are to give practical results they must change to meet every change in the factory equipment and operation.

The science of numbers is not a subject for discussion and resolutions by trade bodies. It is founded on the principle of the decimal and its practicability is universally admitted.

A story is told of a man who was shipwrecked upon an island where the natives knew nothing about the science of numbers. One day a wrangle occurred over the division of a lot of cocoanuts. The traveler counted the cocoanuts and found that there were just one hundred. He counted the twenty natives in the wrangling group and told them that if each would take five they would be equally divided. Finding that he had such wonderful skill in administering justice they gave him a high place of honor. He knew the fundamentals of numbers. They did not.

If the science of numbers was as little understood among manufacturers as is the science of cost engineering, it is probable that each man who had worked out some experiment with numbers would desire that every other one should adopt the formula which he had hit upon. If none of them really knew anything of the fundamentals, they might get together and decide that they would all follow any formula which the majority favored.

To follow the analogy further, they might label the result of their effort "The Standard Formula of Num-

bers" and decide that since standardization had been created by fiat, no change should be discussed at future meetings, lest their standard be destroyed, and the onus of imperfection be placed upon the sponsors of the formula.

Notwithstanding that a correct method gathers strength and increases the confidence of those who use it in proportion to their use of it, these sponsors find it necessary to ward off attacks upon their so-called principles by passing a new resolution of confidence at every meeting.

Now if a man from the outside offered them the fundamental principle of decimal calculation, these sponsors would refuse to listen to him because "standards have been fixed and will admit no change, lest uniformity be destroyed." The "fetish or uniformity" is placed before accuracy, before practicability, before reason, and before fundamental principles. These people are more stupid than the islanders who gave the place of honor to the man who knew the fundamentals of numbers, who could see beyond the formula of figures, and use them to establish the great principle of justice.

The science of numbers, the science of accounts, the science of salesmanship, the science of costfinding, and every other science which has to do with the relations of people, must be established upon fundamental principles which will not be found wanting when weighed in the scales of justice.

Worshiping a fetish, even the fetish of uniformity, is a poor occupation, in a day when active minds are seeking after truth. The man who puts his faith in a fetish, instead of founding it upon the eternal principles of the universe, is bound sometime to realize that he has built his structure on shifting sand.

CHAPTER SIXTEEN

The Psychology of Commercial Success

All Business is Buying and Selling—Manufacturer a Dealer in Time and Materials—Skilled and Unskilled Workers—Selling Service—What is Good Will—Individual Independence Impossible—Psychology, the Science of Mind—Comparative Value of Mental and Physical Effort—The Scope of Machinery—The Engineering Age—The Engineer the Man of the Future—The Disorganized Mind and the Orderly Mind—Fear—Mental Effect of Cost Sheet—Mental Effect of Untidy Office—A Choice of Partners—The Elements of Successful Business.

All business is buying and selling. Some people have said that buying should be done in the cheapest market and selling in the highest. That is a superficial viewpoint.

All kinds of business are governed by the same fundamental principles. The department store manager buys different kinds of goods, of different grades, and is prepared to furnish his customers with any assortment or quantity they may desire. The manufacturer buys materials and labor of various kinds, and grades, and is prepared to furnish them to his customers in any form or quantity desired.

The merchant deals in units of dry goods, hardware, etc., the manufacturer in units of the time of skilled or unskilled workmen, and such materials as may be necessary to create what the customer desires.

Because the merchant has been trained in handling commodities which are resold in practically the same form as purchased, he has become accustomed to placing a value on every item in his stock. He finds it necessary, in order to avoid loss and protect his capital, to see that every penny's worth of goods that goes out of his store is either paid for in cash or charged to the customer who gets it.

Manufacturing, in the modern way, is much newer, and manufacturers have not been drilled in the knowledge of values as have merchants. Their "goods" are

bought in one form and sold in another. They have not learned fully that they must consider time as the most important factor in which they deal; that it is just as necessary to charge the items of time which the customers get as the items of merchandise; that each item of time has a value, created not by the wages paid for it alone, but by all of the elements of expense involved in the process of which the time is a measure, and that it is influenced by volume, just as the merchant's cost of doing business is influenced by volume. The manufacturer needs the commercial viewpoint.

Every man has something to sell. He is either a salesman or an order taker. The skilled workman is a salesman. He has something for which there is a demand and sells it where he can get the highest price. He sets the price. The unskilled workmen has something to sell for which there is less demand. He takes the order and delivers the low grade goods at the price the customer is willing to pay.

The reason a thing can be sold for more than was paid for it is because the dealer has added to it something that makes it worth more. The added element is "service."

The farmer buys seed from the seed merchant at a price which covers not only the cost of the seed but the element of service furnished by the merchant in providing the stock for the convenience of the farmer. The farmer plants the seed, gathers and threshes the grain and sells the grain and straw at prices which not only cover the cost of the seed and the rental of the ground but the element of service which he provided. The commission merchant buys the straw, and resells it to the strawboard manufacturer at a price which includes with its cost the pay for the service which made it unnecessary for the manufacturer to spend time and money traveling through the country buying straw and arranging for shipment. The board manufacturer changes the straw into strawboard, and sells it to the jobber in large quantities

at a price which pays for his service as well as returns the money which he spent for material and cost of production. The jobber in turn distributes the board to paper box manufacturers at a price which covers his cost and expenses, and the element of service. The box manufacturer forms it into boxes of the description which his customer desires, and receives for it a price which yields him a return for the element of service which he renders.

All commercial activity is made up of buying, selling and service. The element that creates real business is service. You may buy in a cheap market and sell at a higher price, but if the element of service is lacking you are not building business.

Permanent business is built on the foundation of good will. Not one man in ten knows what is good will. Some men when they sell a business, demand a price for good will. Often the good will is only imaginary. Good will is the margin of service which was delivered to the customer beyond what he was asked to pay for.

If you sell an article to a customer at a price which leaves him with the impression that he paid all or more than it was worth you create no good will. But if you deliver an article to a customer at the moment that he needs it, and it is made so well that he never has reason to make a complaint about it, and the price is such that he feels that he got a square deal, you have delivered a margin of service which will come back to you in future business and recommendations of your service to others.

No man is independent. All the people of the earth are dependent more or less upon each other. There must be contact with other people in every walk of life. This contact is not the contact of body with body but is the contact of mind with mind. The better we understand the nature and laws of the human mind, the greater is our chance of success in selling our services to others at a profit.

Specialists have studied the action of the human mind for centuries, and have developed what is called

Psychology, or the Science of Mind. It is a study of the mental processes. The salesman should study psychology, because his work is that of influencing the minds of men to think as he believes they should think about that which he has for sale.

Very few salesmen understand the fundamental laws which are the foundation of salesmanship. No man could become a great musician who did not study the laws of harmony in sound. No man could be a great painter who did not study the laws of harmony in color. No man can become a great salesman who does not learn the laws of sale which are the laws of the human mind. We cannot all be musicians; we cannot all be great painters; but the musician, the painter, the merchant and the paper box maker, must, if they will succeed, be salesmen.

Just as a plan of life that did not include the training of the mind would not be complete, so this book would be incomplete if it did not include reference to the study that is more universally needed than any other.

Several years ago, when the writer was in the employ of the National Cash Register Co., the president of that great concern, who was then drawing a salary of one hundred and forty-four thousand dollars per year, said, "A man is worth two dollars a day from his chin down. Whatever he is worth more than that is due to that part of him which is above the chin." His salary was proof that there was practically no limit to the value of brains properly trained and directed.

Harrington Emerson, the great efficiency engineer, says that physical energy equal to that produced by one man in one day can be developed by mechanical means at a cost of eight cents.

Practically anything that can be done by manual labor can be duplicated with a higher degree of perfection and greater uniformity by mechanical processes. The number of processes that have not already come within the range of machine production is rapidly decreasing. Forms of product that formerly required days of the

time of workmen are now produced with greater accuracy and uniformity in an instant. The future of the youth is not in the skill of hands, but in the training of his mind. This is the age of the engineer. Dr. Frank Crane, whose editorials are of such general interest that they are published simultaneously by a large number of daily papers in all parts of the country, says:

"The man of the future will be the engineer.

"He is the man who can Do things; and is better than the man who Owns things.

"The Millionaire is a temporary, passing, makeshift product of civilization. He is merely holding things together until the people get sense enough to do their own owning.

"Some day little boys will read that the world once had millionaires and huge private wealth units, just as they will one day read and wonder that men once had kings.

"But the official who will forever be indispensable is the engineer.

"We need the Engineer to arrange the transportation of people and goods from place to place, without waste, without competition, without graft, looking only to the public good.

"We need the Engineer to get meat, bread, and milk from farm to citizen, without the present inefficient tangle of trusts and middlemen working at cross purposes.

"We need the Engineer to turn the profit of public enterprises toward building good roads and bridges, instead of enriching a few shrewd manipulators.

"We need the Engineer to manage a city as economically and smoothly as if it were a manufacturing plant.

"We need the Engineer to organize the farmers so that all can work together for each and their products marketed without being preyed upon at every step of the way from farm to household.

"Wealth can be taken away from us. But the power to Do things cannot be taken away.

"The Millionaires could go and not be missed. The Engineers we cannot spare."

We are learning that better results can be attained in any line when we understand its fundamentals. Specialists are devoting their lives to the study of individual subjects for the purpose of reducing each to a practicable science.

The Century Dictionary defines science as "Knowledge gained by systematic observation, experiment and reason; what is known concerning a subject, systematically arranged." Thus we see that every subject which affects the welfare of the human race is being reduced to a science. Men are making systematic studies of phenomena, recording and coordinating the results of their experiments and observation.

The man who fails today has no one to blame but himself. Opportunities for study and self-development are greater than ever.

The manufacturer who would succeed must be a scientist in his line. He must study what is known of the subject, until he has mastered every phase of it. He should study the principles of mechanics and their application in the manufacture of his product, if he would get the best results from his factory. He must study psychology in order that he can deal fairly and amicably with his employees. He must study salesmanship if he is to direct his selling organization or make the sales himself. He should know all that is to be known about the origin and production of the various items that enter into his product. He must study costfinding if he is to be able to convince others that his prices are intelligently made and fair to both himself and his customers.

The day of muscle is waning. The day of mind is dawning. Great men are not great because they have great muscles. They are great because they have well trained minds. The difference between the successful

man and the unsuccessful man is not physical; it is mental. Pope said, "The study of mankind is Man." We have been studying man, and have found that the greatest thing in man is Mind.

The mind of the average man is a disorganized mass of impressions gathered throughout an aimless career. The mind of the successful man is a more or less orderly arrangement of the data which he has gathered in a directed effort to fit himself for some special work. How successful he will be depends upon the choice of data he has made and the care with which he has arranged them for future availability.

Many paper box manufacturers are in the business simply because they wish to be their own bosses, and have no other thought than to earn a livelihood for themselves and their families. They have never studied the principles of business, and frequently are found with some very mistaken ideas.

One thinks that if he can keep his factory busy the business will be profitable in proportion. He has not learned that there is a very wide difference between business and "busyness."

The vital thing in business is *profit*. Sales without profit create waste effort and destroy opportunity.

Profit can be increased in but two ways: reducing the cost, or increasing the price. The latter is hardest to accomplish. Study of methods and knowledge of costs are essential to the first. More efficient equipment and a loyal spirit on the part of the employees are great helps. A study of the findings of the Cost Engineering system will show where the losses occur, and consequently disclose the weak places in business methods.

The margin of profit is the important thing. The proportion of the order which is profit is always relatively small. It is to increase that margin that he should work.

Few box manufacturers realize that if they can by good salesmanship increase the selling price five per cent,

it frequently results in increasing the profits one hundred per cent. A reduction in the cost of five per cent on the order that would otherwise yield five per cent profit will have the same effect.

Fear is a mental terror. It makes the box maker hesitate to ask a fair price for the product which is not yielding a fair profit. There is the fear that he will lose the order, the fear that the customer will think he is making too much. Study of the cost system will show exactly what the truth is in regard to the profitableness of the order. If the higher price is fair the customer can be convinced by showing him the cost sheet, and the method of finding the cost.

Don't be afraid to show a businesslike cost sheet. It will create a confidence in the fairness of your prices that can be created in no other way. Buyers frequently tell the manufacturer who uses a Cost Engineering system that if that is the way he finds the cost he can have all of their business and make the prices when the work is done.

Much depends upon the impressions created in the minds of your customers. An untidy office is pretty apt to indicate a chaotic mentality in the man behind the business. A man's character is bound to show in the things which he owns or works with. Carelessness in records is never permitted by the man who is careful of the details of his processes. A man cannot do one set of things thoroughly and be slovenly in another.

The man whose office and factory have a shabby run-down appearance often tries to tell a traveling salesman how profitable his business is. The effort is wasted. The traveling salesman who has ability enough to travel for any length of time gets a training that enables him to tell better than the boss whether the shop is prosperous. The boss can fool himself but he will fool very few salesmen.

Experience and observation are twin teachers whose efficiency is unquestionable. The salesman gets both of these in a very large measure. His deductions as to the

financial condition of a concern are frequently more reliable than the reports of a mercantile agency.

In a choice of partners for a manufacturing business the author believes that as between a salesman and a good mechanic the advantage is all with the salesman. Two workmen who go into business together will fail within a very short time in four cases out of five. If an efficient workman and a good salesman go into business together there is a much better chance of success, for at least one of them knows something of the fundamental principles of business. Two salesmen, of wide experience, temperamentally suited to each other, will usually win.

Why does the workman fail? Because it is a commonly recognized fact that the probabilities of success in any undertaking are in the ratio of his understanding of the fundamental principles which underlie the work in hand. Skillful workmen must give their best effort to their work or they would not be skillful. This precludes the possibility of their giving their attention to a study of business principles. The workman reaches a point where he sees no opportunity for advancement as a mechanic. He becomes restless, saves a little money and decides that his experience fits him to go into business. He knows the product and how it is made from start to finish.

He has seen the boss wearing good clothes and apparently taking life easy. He is a better mechanic than the boss and is sure that he can make boxes better and cheaper than the prices that are being charged for them.

He invests his money. The shop viewpoint has always been that material and labor were the chief expenses. The others were negligible. He makes prices under the old employer's, but is sure he can afford to. He keeps no records because he knows the business so well he does not need to. In a few months he fails and cannot understand why. Lack of capital is given as the reason. All failures are caused by lack of capital.

Why did he lack capital? Because his outgo exceeded his income. That condition will create a lack of capital sooner or later in any concern. How long it will take depends upon how much they have when they start and their ability to bluff the supply houses.

The fact was, he did not understand the law of success. He had not made a study of the principles of business. He had studied the principles of production only.

When the salesman, the business-trained man, went into business he did not pretend to know all about the production elements. He was on his own ground. He knew that to succeed he must sell the product at more than it cost. He depended for his information not upon a vague assumption of knowledge, but upon actual records of performance. He watched his income and his outgo.

If he didn't have a cost system he at least knew the principles of business and avoided the mistakes which caused the workman to fail.

The manufacturer who would succeed must first get the commercial viewpoint. He must realize that he is selling commodities just as surely as is the merchant. He must get more for his product than it costs him or he is bound to fail.

He must keep in touch with the details of his factory operation, not through observation alone but by the use of records. He must realize the importance of the little things that he has been accustomed to look upon as insignificant.

He must have such a grasp of the elements of cost and their application to his product that he can convince his customers of the fairness of his prices, and hold their confidence through continued fair dealing.

He must study the laws of psychology that he may sell his goods profitably and deal fairly with his employees. He must study the fundamentals of his business

and its relation to other businesses, that he may become a worthy factor in the industrial fabric.

He must deliver with every order the quality of service which will make the transaction mutually profitable to both himself and his customer; thereby building for himself and his business a balance of good will which will make his business not only profitable but permanent.

Enthusiasm is the thing in a man's makeup which stirs him to make many good New Year's resolutions; *determination* is the measure of the worth of enthusiasm.

Inspiration leads man to try new things, to seek new ways, to climb; *understanding* is the attribute which materializes inspiration.

Optimism pulls a man up to a better working plane, keeping him right with himself and with the world; *ability* crystallizes optimism.

Enterprise starts a man off along new paths; *resourcefulness* keeps him on the best of those paths and furnishes him with a spur through life.

Initiative lifts man out of his time-worn ruts; *fitness* keeps him on the crown of the road.

And, above all, *responsibility* together with an amalgam of all these attributes, brings *success.* —*Brill's Magazine.*

CHAPTER SEVENTEEN

Getting the Most Out of Your Business

The Age of Specialization—The All-Round Workman a Poor Workman—Necessity for Organization—Definite Lines of Authority and Responsibility—The Chaotic Factory—The Organized Factory—Charts—Object of Business—Effect of the "Filler" on Business—Limited Range of Effort—Volume Not Vital—The Part of the Price that Really Counts—Armour on "Sentiment" Effect of Feelings—Value of Analysis—When a Transaction is Really Completed—The Importance of the Margin of Service.

Failure often is the result of allowing a business to drift. Momentum never yet carried a craft up stream. Indifference and contentment expose the frail industrial bark to danger upon the shoals of apathy, ignorance, egotism, and arrogance. Constant activity at the oars of trade is necessary for commercial progress.

"Eternal vigilance is the price of liberty"—from losses, as much as from anything else. Keep the eyes and the mind open for new ideas that can be utilized. No man knows so much that he can afford to stop learning. A new viewpoint, a new method, may revolutionize an old business. Select something that you can do well, and profitably, then specialize.

This is an age of specialization. "The jack of all trades is master of none." That was true in the eighteenth century, which was a time of simplicity compared with our day. The man who is an all round workman in any trade today is in practically the same position as the jack of all trades of the olden times.

Today, a workman is a specialist. He does one thing, performs one operation of a many-processed trade; but he does it better and faster than it could be done in the old days. The business executive who would succeed must also be a specialist. A man cannot be a good salesman, a good manager, a good factory superintendent, and a skillful workman at the same time.

Many box makers pride themselves on their ability to go into the shop and do any kind of work and do it well, but if they keep up the necessary dexterity of hand, and mental attitude, to be good workmen in the shop, they do it at the expense of the commercial side of the business. The test is given when actual records of performance are compared with those of other skilled workmen whose minds are concentrated on their special work.

No man can have his mental eyes constantly searching his field for new business, and at the same time keep in touch with all of the details of his factory. He cannot study the problems of manufacture as they should be studied to keep down the leaks if his commercial duties take the attention that a good salesman must give to the demands of his customers.

No work can be well done, except through concentration of effort. To be a good manager is a man-sized job. To be a good workman, to be a good superintendent, to be a good salesman, each is worthy of the best that there is in us.

With the advent of specialization comes another new element—cooperation. Teamwork is a great factor in modern business. The manager, the salesman, the superintendent, and the workmen, each specialists in their particular spheres, unite their effort in a single plan. They work to a single end—success, and they succeed.

There must be organization or there can be no cooperative effort. Most paper box manufacturers have never learned the value of organized effort. They have thought of their business as a collection of men working under a boss. That is the old way. It will not do for modern business. The modern way is more definite, more effective.

In a modern business there should be unity of purpose. Just as a machine is made up of many parts, so

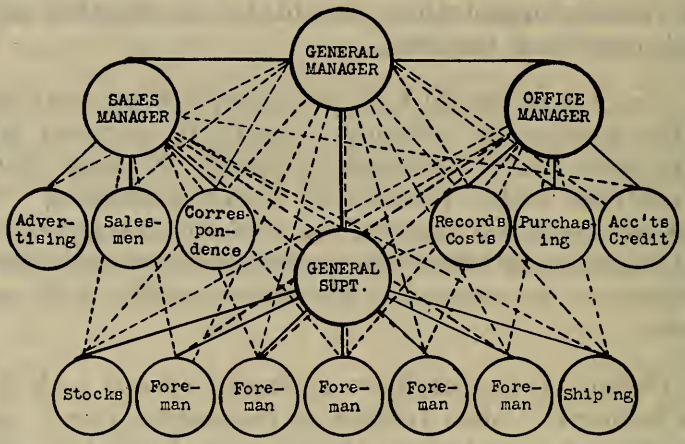
arranged as to operate with the least possible friction, but all designed to produce a certain result; so the modern factory organization should be coordinated as a profit-producing machine.

Every man should have his place, just as every part of the machine is designed to work in harmony with every other part in attaining its object. No man should be confused with a multiplicity of responsibilities. "No man can serve two masters," in modern language means that he cannot be responsible to two different individuals. Neither can he succeed if his duties conflict with each other.

Definite responsibilities go hand in hand with definite authority. Most friction in factories is due to lack of a plan of organization. Every man should have definite duties, and his mind should be clear as to what those duties are. Every man should be responsible to some one higher up for the manner in which he performs those duties. No man should have to report to two bosses. Every man in authority should know definitely the limitations of his authority, as well as to whom and for what he is responsible. Defined duties will prevent misunderstandings, make it difficult for one at fault to excuse himself by shifting the blame for error on to some one else, make each man feel the importance of keeping up his part, and assure each that he will get full credit for his effort, as well as be certain to be criticised for laxity.

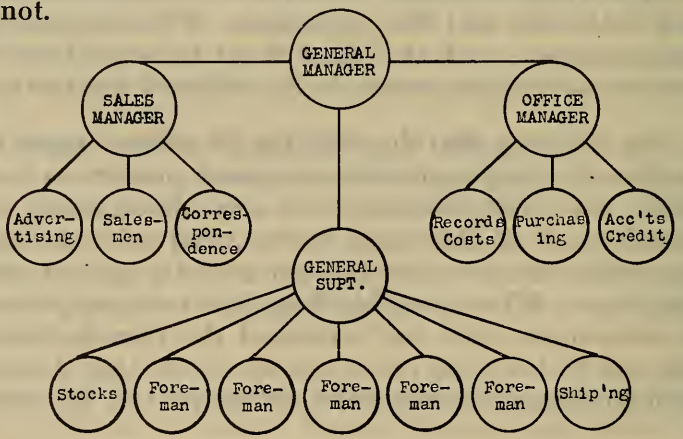
The business that depends for its success upon the activities of a single mind stands upon a precarious foundation. One man presumes to be capable of seeing and controlling all of the active factors, and when he fails never thinks to blame himself but makes a goat of some subordinate. When some big thing is to be accomplished, the subordinate who has presented the idea is pushed aside and he takes the reins and the credit, thus destroying initiative and hearty effort on the part of the other.

The following diagrams show the difference between the way the average box factory is operating and the



plan by which friction may be avoided and cooperation secured:

The first diagram represents a condition common where one or more executives interfere with the normal functions of all branches of the business. They butt into the duties of other officers, so that they not only cannot plan and execute the work, but must expect criticism and orders to change their plans before there is an opportunity to see whether the results will prove up to expectations or not.



The second diagram shows a plan of organization in which authority and responsibility are defined. This plan will eliminate friction.

Success in modern business is easiest won by selecting for positions of responsibility the best men available, giving them definite responsibilities and the authority to carry their work to the finish unhampered. If they do not succeed there can then be no question as to whose is the fault.

Keep in mind that you are not in business to make paper boxes. The making of boxes is simply your tool for the more important business of making profits. If more managers would get this idea indelibly fixed in their minds there would be little price cutting, and a greater effort to learn the cost and other facts of production.

In making prices it is well to forget the competitor entirely. Learn the cost of producing boxes in your own factory and see that your prices cover a fair profit above it. Profit begins where expense ends.

One of the most serious menaces to the industry is the belief on the part of many that they can afford in the dull season to take orders at cost or less for the sake of keeping down the "overhead," or to keep the plant busy.

Keeping the plant uniformly busy is very desirable, if it can be done on profitable work. But the so called "filler" fills nobody's pockets except the customer's. The result of the filler is always to destroy good profitable business.

The customer who buys the filler in the dull season will always demand and expect to get the same price in the busy season when he wants his order duplicated. You dare not take him into your confidence and explain the conditions under which the low price was given. If you do, he will not only fail to appreciate the saving you voluntarily gave him, but he will immediately start scouting for a box factory that is dull and needs a filler. Next

season he will arrange to hold back on the business, that you might profitably handle, until the dull season, then hammer the price down still further with a threat to take the work elsewhere.

If you make your prices on the basis of a known average cost, and stand pat, and your competitors will do likewise, your busy seasons will carry the dull months, and all will make a fair profit. There will be no demoralization of the industry as there is today.

If you cannot do that, bend your energies to the selection of a specialty which you can make for stock in your dull season and sell readily at a profitable price in the busy season.

Get away from the idea that because you are making paper boxes you must try to make every kind of box that is used. Specialization applies to factories as much as to individuals. We can do best the thing that we do oftenest. If you will give your attention to the building up of a trade in a certain line of boxes you will find that you can create great economies in production, that will greatly increase both output and profits, at prices which, while legitimate, are so attractive that consumers of that class will soon find that you are giving them quicker and better service at economical rates, and your competitors will have an opportunity to develop as specialties some of the lines which you no longer find desirable. Thus the objectionable features of competition will be diminished, the entire trade benefited without harmful effect on the consumer.

Too much importance is given to volume of business. Considering the number of large and small concerns there are as many failures among the large concerns as among small. A small or medium-sized business that is profitable is better than a large business that can barely break even or is losing money. There is no relation between volume of business and profits.

The important thing to keep in mind is the profit-

ableness of the business which you can get without having to sacrifice the profits in the effort. The relation between the turnover and the net return is worth considering. Every loss should be specially investigated to find the cause and stop the drain. It is better to take a hundred dollar order at ten per cent profit than to take a two hundred dollar order at five per cent profit. While the net result financially is the same, the mental and nervous energy is less on the smaller order.

Remember that whereas the selling price is one hundred per cent, the profit is only ten per cent, and that each one per cent taken off of the price reduces the profit ten per cent. Profit is the only part of the price that really counts when the transaction is closed.

The greatest asset a concern has is the loyalty of its employees. Nothing should be permitted to destroy the good will or confidence of the workmen and other employes. J. Ogden Armour, in a special article in the *American Magazine,* says:

"Sentiment in business was never more alive than it is today. Any able employer of labor knows that kindness and fairness build the cornerstone to a man's best effort. From a purely commercial standpoint, discarding all other reasons, they are the soundest investments in the world. You can buy a man's work, but you cannot buy his loyalty. That can be gained only by treating him fairly. I have declared repeatedly that any success that has come to me has been due almost entirely to the loyalty of my men and their eagerness to please me. I consider this sentiment of more value in dollars and *sense* than the entire financial investment in our business.

"I do not want my men to work because they fear me, or because they are afraid of losing their jobs. I want them to work because they want to work, because they would rather work here than any other place in the world. A man is no good to me unless he is necessary to Armour & Company, and we are necessary to him.

"As a matter of practical business common sense, I make it a rule that my door shall always be open to my men, and any employee, down to the humblest day laborer, may feel free at any time to bring his troubles to me directly. My job would not be worth while under other conditions.

"In the last analysis, a business and an individual have much the same characteristics; they make friends and enemies in exactly the same ways, and nothing pays either quite so well as to be fair."

After all, men do not do as they know, they do as they feel. Men who drink to excess, know that it is harmful, yet feeling or desire carries them over the point of reason and self-control. Your employees know that it is their duty to give you a full day's work for a full day's pay, but whether they do it or not depends upon their feelings toward you, rather than on their sense of duty.

A factor of vital importance which is not given the consideration it deserves is that of the health of the employees.

A manufacturer must not only have a Cost and Production Record System, but he must keep in close touch with showings if he will realize the tremendous drain that occurs from his profits by reason of the absence of employees.

Absences, preventable to a large extent, are responsible for delays, disorganization of the forces of the shop departments, and an atmosphere of uncertainty throughout the entire business.

Promises cannot be kept unless the workers are present regularly at their machines and benches. Even then the condition of health must be such as to insure their giving a reasonable day's work in return for the pay they receive. Customers become dissatisfied with the service of a manufacturer who cannot be relied upon to deliver his product at the specified time.

Mere presence at the machine or bench is not all that

is necessary. A healthy worker will do more work than one who is indisposed. The average manufacturer who pays his help on a piecework basis is prone to overlook the importance of health. He becomes accustomed to the thought that he pays only in proportion to the amount of work delivered by the employee, failing to realize that even in a well managed factory, the elements of operating expense aside from payroll are greater than the payroll. These expenses go on whether the production center is operating to its full capacity or not. Certain of the expenses are accumulating even while it is idle.

Factory conditions have much to do with the health of the employees. So important is this factor that the Cloak, Suit and Skirt industry in the City of New York has appointed a Joint Board of Sanitary Control, with power to regulate factory conditions that relate to the health of employees.

This Joint Board has developed a schedule of twenty-eight sanitary standards which they have expressed so concisely that it is worth while to incorporate them in this chapter for the information of paper box manufacturers:

1. No shop to be allowed in a cellar.

2. No shop to be allowed in rear houses or attic floors, without special permission of the Board.

3. Shops located in buildings two stories or more in height must have one or more fire-escapes.

4. All fire-escapes to be provided with ladders to the roof of same house or to an adjoining house; also with full length drop ladders, properly located and adjusted.

5. In all shops which are not provided with automatic sprinklers there should be a sufficient number of chemical extinguishers, or a sufficient number of fire buckets, properly located and filled.

6. Special caretakers to be appointed in each shop for the care of the fire buckets, and for their use in case of fire.

7. All openings and exits to fire-escapes to be left unobstructed by tables, machines, boxes, partitions, and iron bars.

8. No doors to be locked during working hours.

9. No smoking to be permitted in workshops.

10. Conspicuous signs to be placed throughout the shop, marking location and direction of exits and fire-escapes.

11. Fireproof receptacles, lined with tin, and having a tin cover, to be provided, in sufficient numbers, for rubbish.

12. Halls and stairways leading from shops to be adequately lighted by natural or artificial light.

13. Stairs to be provided with secure handrails and safe treads.

14. Sufficient window space to be provided for each shop, so that all parts of the shop be well lighted during the hours from 9 A. M. to 4 P. M.

15. Where gas illumination is used, arc lights or incandescent mantles should be used.

16. All light to be well shaded, to be placed above operatives, and not too near them.

17. At least 400 cubic feet of space, exclusive of bulky furniture and materials, should be provided for every person within the shop.

18. The shop should be thoroughly aired before and after work hours, and during lunch hour, by opening windows and doors.

19. No coal should be used for direct heating of irons (adhesives) and whenever stoves are used for heating shops, they should be surrounded by metal sheet at least five feet high.

20. Walls and ceilings of shops and water-closet apartments should be cleaned as often as necessary, and kept clean.

21. Floors of shops, and of water-closet apartments, to be scrubbed weekly, swept daily, and kept free of refuse.

22. A separate water-closet apartment shall be provided for each sex, with solid partitions to extend from floor to ceiling, and with separate vestibules and doors.

23. Water-closets to be adequately flushed and kept clean.

24. A special caretaker to be designated by the employer to the care of the shop and water-closet apartments.

25. A sufficient number of water-supplied wash-basins to be provided, in convenient and light locations within the shop.

26. Suitable hangers should be provided for the street clothes of the employees, and separate dressing rooms to be provided wherever women are working.

27. Water-closet apartments, dressing rooms, wash-rooms, and lunch rooms to be properly lighted, illuminated, ventilated, cleaned, and kept clean.

28. All seats to have backs.

Study your business. Study its needs, its strong features, but above all, its weak features. Analyze every case of trouble. Get at the facts, and do not hesitate to face them squarely. If you do not face them now they will come back later and stare you in the face demanding recognition. If you slight the opportunity for analysis, you may develop a case for autopsy.

Analysis means a study of all of the elements, individually and in relation to each other, for the purpose of development. Autopsy is the post-mortem examination made for the purpose of locating the trouble, when it is too late either to better the condition or save the patient.

Provide for frequent analysis by installing the most practical costfinding system obtainable. Give the necessary time to learn how it is designed and how to make

the best use of it. There is nothing mysterious about a cost system. What appears to be mystery is simply the mist of ignorance. Things seem vague and mysterious only as they are unknown. The known is always simple.

Finally, in your dealings with your patrons remember that no transaction is completed until the customer is satisfied. Getting the money does not close the deal. You must earn more than the money, if you are to succeed in business. You must earn good will.

Most people have an idea that good will can be created by spending money for publicity. This is a grave mistake. Every particle of good will that a concern receives, or is entitled to, represents a margin in service delivered above the price asked for the service. The customer who feels that he paid for your service all that it is worth, holds himself under no obligation to you; but the customer who feels that your service was worth more than he paid, holds in reserve a margin of good will which he is ready to pay promptly whenever he feels that he can do you a good turn.

To get the best results from your business you must ever keep your mind open to new ideas and methods; you must establish lines of authority and responsibility within your organization that you shall deserve the confidence and loyalty of your employees; you must know your cost so that you can deal fairly with your customer, yet receive the fair profit that is your right; you must analyze your factory to know its needs in time to prevent waste and loss; you must deliver to your customer, in addition to the tangible product for which you take his money, a less tangible, but no less important margin of service which shall bind his good will to your business that it may continue to grow and prosper.

CHAPTER EIGHTEEN

Pitfalls in the Pathway to Profits

The Causes of Failure—Effect of Conditions—Nine-Tenths of Failures Preventable—All Great Forces Invisible—Experience the Great Teacher—Ignorance a Relative Term—The Pitfalls—Apathy—Procrastination—Conceit—The Superficial Viewpoint—Conservation That Wastes—Aggressive Competition—Worshiping Precedents—Responsibility Without Authority—Demanding Results Without Providing Equipment—Looking Through the Wrong End of the Telescope.

In the mind of every man who ventures into business for the first time, is the positive conviction that he is going to succeed. No man would make the venture if he thought he stood an equal chance of failure. Someone has said that ninety-five per cent of men who go into business fail. That may or may not be true, but it does not necessarily mean that they all prove total failures. Some of the most successful men in America failed in their first business venture.

Failure is always the result of conditions. Nine-tenths of the causes of failure are avoidable. In other words, they were due to conditions which can be remedied, and future failures from the same causes prevented. That is because nine-tenths of the failures have been due to reasons traceable to the persons engaged in the businesses which failed, and not to conditions over which there could have been no control.

This book has been written to help paper box manufacturers make larger profits; to help paper box manufacturers succeed. It would not fulfill its mission if it did not call his attention to the unseen snares and hidden pitfalls of which he must beware if he will escape the fate of the ninety-five per cent who fail.

Few men who fail know why they failed. Almost invariably they name as the cause something which had little or nothing to do with the misfortune. The man on the spot cannot see the spot. Usually the man who fails is so close to the cause that he needs the mirror, instead

of the microscope, to get a view of its physical evidence. But the real cause he cannot see.

The great forces of the universe are invisible to the physical senses. In time we learn to know the power of these forces through experience. Whoever saw the forces of gravitation and momentum? Yet these are the forces that move the air with the swiftness that destroys in the tornado. Steam and electricity under the conditions which make the exertion of their energy possible are invisible. To the man who knows nothing of the forces which move through them the "dead" engine and the "live" wire look no different from the "live" engine and the "dead" wire. The evidence of the power is in its action.

There are unseen economic forces working constantly in the business world, building or destroying, pressing forward or retarding, according to the conscious or unconscious control of the individuals responsible for the business concerns in which these forces are at work.

The great difficulty is that they are unseen and unknown to those whose interests they most vitally concern. Much that the author will write will sound like platitudes to the average reader's ear. It is the fear that these things be treated as platitudes that discourages the hope that they will be heeded. The tendency of the reader too often is to think that these things apply to the other fellow and not to himself. The really ignorant man is wise in his own conceit. We are not conscious of the thing which we do not know. That is why it is so hard for us to learn the lessons we need until a jolt wakes us to a realization of some deficiency. The big force that causes more failures than any other is the negative force of *ignorance.*

Ignorance is an underlying cause. It manifests itself in many ways. The unsuspecting are its victims. The most learned in some lines are absolutely ignorant in others. The term "ignorant" is not necessarily a cause for offense. We are all ignorant of most of the things

that we ought to know. Mankind has discovered comparatively few of the mysteries of nature. Compared to Omniscience, what the wisest of us knows is comparable to a drop of water and the ocean. We must not then take offense if we are called ignorant by someone whose object is helpfulness.

This chapter is about "pitfalls." No man would step into a pitfall, knowingly. If you have business troubles you have stepped into some of the pitfalls that lie in the path of the business man. If you knew they were there you would have avoided them. It is to tell you of some of them that this chapter is written. If it helps you to avoid even part of them the mission of the book will be fulfilled. But the help is intended primarily for you, Mr. Reader. Apply the message at home, in your own business first, then pass it on to your competitors.

Apathy is the pitfall which lulls its victim into a dreamless sleeplike sense of security. Were dreams to come they might portend the disaster that is sure to follow this attitude. As long as the creditors are not too insistent; as long as the stream of money continues to flow through the business, its decreasing volume being unnoticed, as long as the reserve of credit holds out; all seems well. The hail of friends "How's business?" always gets the same reply, "Fine." The poor deluded mortal tells the same story over and over without stopping to analyze his business to see whether it is true or not.

When the time comes for the financial statement to be made up, he scans the figures, says "This has been an off year, we will not charge off depreciation, our plant is as good as it was a year ago." He hypnotizes himself into the belief that no blame attaches to him, that with a better season next year things will right themselves. By omitting some of the economic expenses he can make a showing to his stockholders. He fills his mind with the things he wishes the directors and stockholders to think and passes them on with such sincerity that he

convinces himself that they are true. He didn't mean to lie about it, but sees no reason why anyone should get worked up over what cannot be helped. All he needs is a chance in a good season to show what he can do. The business is far from insolvent, why should he worry?

The name of the apathetic paper box manufacturer is legion. He is ignorant (he doesn't know) that in the paper box industry he can start in business auspiciously, build up a good trade for the size of his plant, keep the business going for fifteen years, while losing ten per cent of his capital every year. He can do all of that and still double the size of his factory.

One paper box manufacturer read a similar statement in a former book by this author, called upon him to explain, which he did with such satisfaction that the box manufacturer installed a cost system and now finds it profitable to be guided strictly by what it shows him.

Procrastination is said to be "the thief of time." Aroused from the lethargy that has enthralled him, the victim hears the warning but lets it pass unheeded. The danger does not seem imminent. He has never felt the sting of failure, surely it is not meant for him. He is resourceful. He will find a way to hold the danger back when it really threatens. Next week, next month, next year will be time enough. Why should he pay someone else to tell him about his business? He can figure the cost when it is necessary. If real difficulties come, his friends will see him through. Others may fail but he is one destined to success.

Now and then there are indications that all is not well with the business. That financial statement worries him for a day or two. It was harder this time than ever before to make the annual clean-up that the banker insists upon. The banker is a crank anyhow. If he gets nasty, the new bank, which is nearer, will be glad to take his account. Time heals the hurt. The supply house has noticed that he no longer discounts his bills; they have reduced his line of credit. That is a matter of policy.

They have noticed that times are harder, and must play safe. The supply house insists on payments being made on time, but the down payment on the new machine which he just bought took all of the available money. Well, suppose they are insistent, the other supply house has been clamoring for his trade, they can have it. But the glue salesman and the board salesman meet in the hotel. "What's the matter with old Easygo?" "Same old story, asleep at the switch. I've got orders not to sell him any more." "Guess I'd better turn in a report on that." Then comes the real thing. The banker says, "Your financial statement was crooked. I lost confidence in your word long ago." The supply house says, "We saw it coming, our salesman talked to you about a cost system but you thought you knew all about your business. You wanted to try out your own system before hiring an outsider. We knew it wouldn't work, because many have tried it and failed. But you didn't even try, you put it off, and now it is too late."

Conceit is usually not only the boon companion, but the offspring of ignorance. The really sagacious man knows that he can pick up valuable ideas from even the apprentices if he talks to them about the work that they are doing. It is only the ignorant manager who poses as knowing all about his business; who is unwilling to get another's viewpoint; who refuses to go to school again once in a while to the specialist in some phase of business economics, or who does not keep his door open to his employees.

Conceit closes a man's mind to the results of other people's experience; closes his ears to the warnings of his friends; makes him exaggerate every atom of praise and minimize the value of criticism; makes him lie to his banker, to his creditors, to his directors, to himself.

Conceit alienates a man from his associates, keeps him from fraternizing with his competitors, destroys the good will of his employees, and the confidence of his customers. Conceit is an indication that a man is out of

harmony with the race; it is an indication of a small mentality; it is mental astigmatism; it makes a man see things as they are not; makes him think himself the superior of his fellows.

The conceited paper box manufacturer thinks that he can sell boxes cheaper than any other manufacturer, and make a better profit on the sales; that his estimate of the cost is more accurate than a cost system; that his competitors are a lot of "dubs"; and that what he doesn't know about making boxes and profits isn't worth knowing.

The superficial viewpoint seems to be as far as some men can get. The box manufacturer who suffers from having been caught in this pitfall cannot see the necessity for analysis. He says, "My bank account is the indicator of my prosperity. If my bank account goes down I know I am losing money, when it increases I know that I am making money." He doesn't think far enough below the surface to see that when business is booming he takes the money out of the bank and puts it into work in process and accounts receivable; that when business is dull he realizes on the output of the busy season and having less demand for the money in the business the bank account increases. He neither thinks deeply nor gives other people credit for thinking deeply.

The manager of a box factory who is addicted to the superficial viewpoint sees no necessity for conforming to fundamental principles. He uses the rule of thumb in his calculations. He guesses at the cost and guesses at the price. He thinks a cost system is a lot of bother and costs too much to keep up. He figures the cost of the board at the invoice price. He guesses at the cost of the trimming materials. He adds together the piecework rates per thousand, multiplies the result by the number of thousand the customer requires, adds a percentage for overhead, and if he gets the order, congratulates himself that he beat the competitor to it.

He keeps no factory records; has no perpetual in-

ventories; rarely has a financial statement taken off his books. When he does, he declines to consider interest on investment as a part of the expense. Depreciation he considers unimportant. He thinks that all he gets over the cost of the board and labor is profit. Frequently he draws no salary but takes the money needed for personal expenses out of the cash drawer. He exaggerates his statements of profits and minimizes his losses. He keeps his business largely in his head. To him system is red tape. When the sheriff takes charge of the remains of his plant he blames his competitors.

Conservation that wastes is of common occurrence. Doing work by hand that should be done by machinery, rather than make the investment, may seem like an immediate saving but will eventually prove a loss. Going without vital records in your business to save the clerk's salaries, may destroy the profits which should be made on the work of many employees. Using your personal time and energy in trying to install your own cost system may lead you to think that you are saving the engineer's fee but it is only another way of paying a high price for experience. You may like the looks of your creation, be as puffed up as the boy who has made his first kite, but like him you will probably find in the test that its "tale" is either too long or too short, and that after all your expenditures of time and effort it will not work.

You have probably learned that in this day of specialization it is better to buy your shoes than to make them, to employ a physician than to experiment with your health, that the fee of the watchmaker is cheaper than the result of your tinkering. You will also find, as many others have before you, that your effort to install a cost system is a form of false economy that not only endangers your profits but the foundation of your business as well.

Aggressive Competition. Strife between competitors is about as foolish as a fight between two men adrift, over a log which would sustain them both in a state of

peace. They consume their energy to no purpose. In the end both must share the means of support together.

There is just about so much business to be shared between competitors. Strife certainly does not create more, but unquestionably diminishes the profit on that which does exist.

All unfair competition is due to ignorance. The paper box manufacturer who cuts prices either does not know the cost of his product, and makes the prices too low for that reason, or he knowingly makes the prices low in the mistaken belief that he can develop permanent trade by bidding for new customers through the medium of unprofitable business.

Product sold at cost is simply an exchange of dollars without profit or commission, and represents wasted opportunity and wasted energy. Product sold at a loss not only destroys opportunity which might be developed into profitable business, but takes a dollar of the profit on the profitable work for every dollar of loss, before there is an even break.

Profit is the only part of receipts which is worth working for. Competitors would always fare better in the end if they thought less about each other's apparent shortcomings, studied their own costs, and stood pat for a profit on every order, even though there were fewer sales.

Worshiping precedents is a pitfall to which the older generation is particularly susceptible. "The way it has always been done" is a habit, hard to break, and seems the best way, because it is easiest, for them. The average man follows the line of least resistance. He may even see that a new method is superior, and more profitable for him; but if he must expend mental energy in learning it he will have none of it. If all men were of that type we would have no inventions; we would still be in the age of the tallow candle, the ox cart, and hand script. No one ever helped the world, or humanity, to make progress by worshiping the sacred cow of precedent.

Most people think that if they read about something in a book, it is more authorative than if the same idea is advanced by an individual whom they know personally. The author of the book may have lived and written under the conditions of the eighteenth, or even the nineteenth, century. The book may have been an excellent authority at that time, and still valuable as a landmark in the world's progress. But if his teaching does not coordinate with twentieth century methods it is out of date.

The inventor, and the man who advocates a new idea, must expect to be assailed by the critics whose stock expression is "It was never done that way before," or "There is no authority for it in the literature of the subject." Who cares whether it was ever done that way before? The question is: Will it work? Is it better than the old way? If it will serve humanity better than anything previously devised for the same purpose it is worthy of adoption, regardless of whether there is any printed authority for it.

Accountants have failed to find a practical method of determining the cost of making paper boxes, or other product which is required in great variety. They are form-worshippers. Don't blame your accountant for that. His job is one that does not permit originality. He must follow copy exactly or his accounts will not balance. He has been taught that there are certain things that constitute "standard accounting practice" and to let his own personal ideas lead him to do something not authorized by the literature of the profession is heresy.

The most dangerous phase of this precedent worshiping, however, occurs in the factory where there are two generations of the same family. The younger element, in the exuberance of youthful energy, wants the latest and the swiftest methods obtainable. It cannot tolerate the mental drudgery of the counting room, when it can be relieved by the calculating machine. It realizes that conditions are such that the best possible facilities

must be had if they are to keep abreast of the times. But the older generation says "No, I didn't have all of these new fangled inventions when I was young, and you are no better than I was." But the fact is that when they were young, the old fellows had the same disposition to demand the best, and got it because there was not much to get, and little money had to be spent for it. If the new method will pay, it is false economy to do without it.

Responsibility Without Authority. Trying to operate a business without a definite plan of organization is on a par with trying to operate a railroad without a time table or a train dispatcher.

If there is only one man in the business or one train on the rails there would be no need of a plan of operation. Just as soon as two independent units try to cover the same ground there is sure to be a collision.

Duties must be defined. Every line of duty carries with it certain responsibilities. The responsibilities should be definitely stated. Every man has a right to know what is expected of him. Comparatively few men will shirk their responsibilities if they understand fully what they are.

The trouble in this direction is that most paper box factories start in a small way; men are employed and given odd jobs which are at first more or less on the order of helpers, instead of definite positions. Because they are not fired, and do not want to be fired, they keep busy at anything they find to do until they gradually absorb a line of work. They have no definite authority. The management gets into the habit of depending upon them for certain results. Some day in a well intentioned effort they meet in a clash with either the boss or some other employee who is in a similar predicament. Having no definite authority, there is no basis for a settlement of their troubles, and although matters look smooth on the surface again in a day or two, there is a feeling in their minds that each was trying to take an unfair advantage.

It will pay the head of the concern to call together the men whom he holds responsible for the results in the business and factory, and together work out a plan such as was previously illustrated in this book, defining authority and the lines of responsibility. Let some one who is competent make a chart of the organization plan, hanging a blueprint of it in each department as well as the office. Accompanying the chart should be a brief typewritten statement of the duties and responsibilities.

Such a plan will not only provide a basis on which settlement of disputes can be quickly made but will prevent most of the clashes of authority which cause internal friction. No man will have reason to feel that he is a goat or that someone else is a favorite.

Frequent meetings will result in good for the organization, and serve as an outlet for the ideas and feelings which develop from time to time in the minds of the men.

Demanding Results Without Providing Equipment. No sensible manufacturer would demand that his employees deliver product of good quality at a full normal rate of production without the tools necessary to do the work. Yet it is one of the most common conditions to see a board of directors employ a man to look after the business, and tie his hands by lack of proper authority and equipment.

Old employees, relatives, pensioners, and others who serve no good purpose are kept in positions where they serve as obstructors of the policy of the new management. Knowing that he has no authority to discharge them, they simply counteract his efforts to get the concern out of the old ruts and upon what he believes to be the highway to success.

He cannot buy a typewriter without the action of the board of directors. An adding machine which will save in clerk hire more than its cost in a year is looked upon as a piece of non-productive equipment.

The author has seen hundreds of cases where the manager felt that his greatest need was for a cost sys-

tem which would enable him to weed out the losses in unprofitable items of product, readjust prices so that more profitable business could be had, and get a thorough periodical analysis of the business for his information. But, he had no authority to sign the contract.

He must take the matter before a board of directors, composed of men who look upon every innovation that requires either the expenditure or investment of money as a direct curtailment of dividends. His plea for outside assistance in establishing a system is mistaken for a sign of inefficiency. The outsiders think that he should, with his multitude of other duties, work out a cost system to meet his needs. He works along for a while under the handicaps that are placed upon him, and finally resigns, cursing the men who were so short-sighted that they could not see that he was simply asking for the tools which he needed in his job of increasing the profitableness of the business.

They would not expect the men in the shop to build their own machines, or make their own tools, but they ask him to do what no good manager will do—waste his time in experimenting when he can get the result of the experiments which others have paid for on terms that will prove a highly profitable investment, thereby enabling him to devote his full attention to the promotion of the business for whose success he is to be held responsible.

No executive should undertake work that can be more economically done by someone else. The executive, like any other person from whom results are demanded, must be provided with practical tools. Boards of directors frequently in their zeal to save pennies, permit the waste of time and productivity which would yield in profits many times the amount their obstructive policy seems to save. Unless boards of directors keep abreast of the needs of the business, and in touch with modern methods they will deserve the title of "Boards of Obstructors."

Looking Through the Wrong End of the Telescope. The average reader of this book will have had his competitors more in mind than himself whenever there has been criticism of the things that he believes the competitor guilty of. Whenever matters are mentioned which conform to his own practices or seem to conform to them, he is puffed up with the feeling that he himself is living up to the approved methods.

If you ever looked into the reverse end of a telescope you found that the man you saw looked very small indeed. This is the view the average paper box manufacturer has of his competitors. They look small to him. But he should remember that it is their habit to look at him in the same way. He looks small to them.

Now the interests of both would be better served if both would turn their telescopes about. They would appear to be of about equal size, men of about the same characteristics and very fit companions for each other. They would seem very much nearer together, and would be still better off if they would join hands, instead of facing each other, and go forward side by side.

The reader of this book should keep in mind that it is intended to be helpful to *him;* to give *him* some new viewpoints which will increase the profitableness of his business. He should use it, not as a means of showing up the smallness and meanness of his competitors, but as a means of weeding out the weaknesses in *his own business.*

If he does this he will not have so much time to look for flaws in the other fellow's business. They can both get together and exchange ideas and experiences with a feeling of good fellowship and mutual profit.

"Some ships sail East, and some sail West,
In the selfsame winds that blow;
'Tis the set of the sails, and not the gales,
That takes them where they go."—Selected.

ADDENDA

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COMPILED AND ARRANGED BY

THE JOINT COST COMMITTEE

OF THE

NATIONAL FEDERATION

OF

PAPER BOX MANUFACTURERS

ASSOCIATIONS

Addenda

PART I

The Determination and Use of Composite Average Cost Rates, by Robert S. Denham—Specimen Estimates Illustrating the Use of Composite Averages, by Henry L. Stortz—Depreciation Rates Suggested by the Joint Cost Committee—Rules and Regulations of the Box Board Manufacturers Association—Uniform Order Blank for Box Boards, recommended by The Western Paper Box Manufacturers Association—Paper Trade Customs—Uniform Order Form for Paper, Suggested by The Western Paper Box Mfrs. Ass'n—"Safe Short Cuts in Estimating," by W. C. Carlson.

The Determination and Use of Composite Average Cost Rates

By Robert S. Denham

Average Cost Rates determined through complete data compiled in an individual factory unquestionably provide the safest and most practical basis for both Costfinding and Estimating.

In the individual factory a definite amount of product is obtained in a given period and a definite amount of money expended. While some months may be dull and others active the average cost per unit during consecutive twelve-months periods will vary but little. The money, being handled through the same channels and accounts, liquidates the shortages of the dull seasons with the surplus of the busy seasons.

Owing to the fact that certain expenses are constant, while the number of production units varies with the activity of the seasons, creates a relatively high unit cost in the dull season, and a correspondingly low unit cost in the busy seasons. This makes it impracticable to use the average of the monthly averages.

The true average is obtained only by combining the total expenses of the long period and dividing the result by the total of the production units of the process under consideration.

As an illustration we will use the following data:

Month	Expenses	Hours	Hour Cost
January	$1,628.18	1966	$ .82
February	1,636.28	2153	.76
March	1,683.50	2275	.74
April	1,460.64	1432	1.02
Totals	$6,408.60	7826	$3.34

Now if we divide the total expenses by the total hours of the period we find that the average cost per hour is $.819

and adopt the rate of $.82. Multiplying the total hours by $.82 we get the result $6,417.32, which is the amount we would charge for the hours at that rate, a gain of $8.72 because of the use of the full cent instead of the fraction. This is what we call the "true cost," because it is practically accurate.

Now if we add together the monthly rates, or hour costs, we find that they total $3.34 and average $.84. Using this as the charging rate we find that we would charge as the cost of the product of these four months a total of $6,573.84 or $165.23 in excess of the actual cost. This is the average of averages.

Some may think that a discrepancy of two cents in a rate is of little importance, but it is large enough to cause the loss of orders in which hundreds of hours are involved.

In the absence of accurate data in his own factory the best form of substitute is a schedule of composite rates made up from the experiences recorded in other factories producing similar product under similar conditions.

These rates if carefully compiled will be found not only much more accurate than the results of percentage calculations, but their general use will have a tendency to make prices more uniform between competitors, especially if they are used in connection with the average output rates for the same periods.

In compiling the data for the determination of the average hourly rates shown on the table included in this article, the writer has endeavored as far as possible to exclude the extreme items, which because of abnormal conditions would destroy the practicability of the rates presented.

It will be seen by the table on the opposite page that the average costs per hour, for the operations of paper box manufacturing, range from $0.34 cents in the case of finger-hole cutting and closing to $1.44 for lining machines.

In the columns showing the highest and lowest rates reported for each operation, the reader will observe that the rates on many of the operations differ greatly as between different factories.

These great variations require some explanation, for they not only puzzle the inexperienced, but are the cause of misunderstanding between competitors, frequently leading to price cutting and unjust criticism.

Every factory, whether intentionally or not, develops certain lines of trade in larger volume than other lines. At the same time most stiff box factories will attempt to handle every class of work that is offered.

Table Showing Composite Average Hour-cost of Processes in Paper Box Making, the Average Hourly Output, and the Range of Hourly Rates in Factories Making Reports for 1916

Operation or Process	Average Hour Cost 1916	Average Hourly Output 1916	Highest Hourly Cost Reported	Lowest Hourly Cost Reported
Lining Machines	$1.44	710 shts.	$2.40	$ .67
Single Scoring Machines	.61	88 shts.	.99	.51
Double Scoring Machines	.67	508 shts.	1.09	.54
Single Corner Cutters	.44	2160 pcs.	.87	.33
Double Corner Cutters	.50	no record	.61	.44
Quadruple Corner Cutters	.57	2720 pcs.	.65	.52
S. & S. Corner Cutters	.90	10459 pcs.	.94	.85
Bending	.46	no record	.49	.41
Single Staying Machines	.49	472 pcs.	.80	.32
Quadruple Staying Machines	.72	1544 pcs.	1.42	.50
Single Ending Machines	.60	242 pcs.	1.24	.42
Double Ending Machines	.83	no record	1.21	.66
Strip Covering Machines	.49	243 pcs.	1.11	.33
Pony Covering Machines	.43	no record	1.03	.40
S. & S. Wrapping Machines	.99	606 pcs.	1.42	.63
Top and Bottom Machines	.44	367 pcs.	.73	.27
Extension Edge Machines	.46	533 pcs.	1.09	.39
Lacing Machines	.59	483 bxs.	1.07	.36
Finger-Hole Machines	.34	no record	.36	.33
Doming Machines	.71	757 pcs.	1.01	.54
Metal Edge Staying Machines	.60	330 pcs.	1.54	.41
Shears	65	no record	1.16	.48
Board Slitters	.74	no record	1.62	.44
Paper Slitters	.68	813 shts.	1.74	.51
Sheet Cutters	.48	546 shts.	.80	.39
Paper Cutters	.80	no record	1.35	.60
Chopper-Saws	.53	no record	.85	.46
Slotters-Lock Cutters	.60	no record	1.36	.52
Gummer-Glue Machines	.52	no record	1.54	.44
Flange Stitchers	.46	202 pcs.	.81	.32
Flying	.48	no record	.58	.44
Necking	.57	720 bxs.	.64	.48
Tube Machines	.91	1550 feet	1.16	.58
Closing	.34	no record	.90	.27
Men's Hand Work	.48	no record	1.22	.42
Girls' Hand or Table Work	.35	no record	.69	.27
Machine Shop	.62	no record	.84	.51

The result of this condition is that certain types of equipment or processes are kept very busy and develop a low cost rate. Others have much idle time and have in consequence a high hourly cost. The limited number of chargeable hours must carry the total process expense for the full time whether busy or idle.

Every variation in the conditions of different factories is reflected in the cost of their product. A type of equipment operated constantly to full capacity in one factory may be operated but twenty per cent of capacity in another. There must then be a variation between factories.

Some factories are over-equipped and consequently cannot get the cost rates down to normal. Others are under-equipped and are compelled to use makeshift methods which are expensive, thereby destroying the profit which could be made under more favorable conditions.

Inefficiencies are of many kinds, and degrees of effectiveness. They always increase and never decrease the cost of production. This accounts for the fact that the variations from the average costs shown in the table are usually much greater in the upward direction than downward.

Idleness is the greatest factor in creating high costs. Continuous production is the greatest for the reduction of costs. Whenever a manufacturer finds that his cost per hour of a given operation or process is higher than normal he should investigate the cause. When he finds his cost below the normal he should study the method that he may develop it.

The Cost Engineering system affords the best possible index of conditions by which the manufacturer may not only readjust his prices to make sure that a profit is earned on each order, but also increase the efficiency of his factory and organization.

The manufacturer who relies upon the amount of wages to indicate the cost is frequently misled. Every increase in wage payment for the purpose of getting greater efficiency makes it appear that the cost is increased, while as a matter of fact the reverse may be true. Such methods should be tabooed.

USING THE TABLE FOR ESTIMATING

The Paper Box Manufacturer who has no Cost Engineering System covering the data in his own factory can make very safe estimates by the use of this table, as follows:

After making the calculations for the cost of materials required, he should make a list of the operations or processes

which the materials must pass through in making the box under consideration. (A printed form covering all of the processes for which his factory is equipped will prove valuable in preventing omissions.)

He should then either estimate the number of pieces that can be handled per hour by a worker of average efficiency, or use the number shown in the second column of the table. The total pieces divided by the number which can be handled per hour will give the number of hours required to complete the process on the lot. This time should then be multiplied by the rate per hour to determine the cost for the number of hours required.

In some processes it is impossible to set production rates because of the great variation in work. In these cases no output rates are given, and an estimate must be made according to the best information obtainable.

The total Estimated Cost of the prospective order will then consist of:

(a) The Cost of the materials, including expenses in connection therewith.

(b) The Total of the Process Costs figured at the hourly cost and output rates found by experience, or shown on the table presented herewith.

The amount paid in wages must under no conditions be confused with the hourly process cost rates. Wages is but one of many elements. The correct cost rates include all elements.

When cost is estimated correctly, nothing except the profit is to be added in determining the price to be asked for the order.

NOTE—It is the intention of the Joint Cost Committee, if the industry encourages such action, to compile and publish new Tables of Composite Rates semi-annually. In that case each succeeding table should be more complete and accurate than the last, as the number of users will continually increase, and a better understanding of the Committees' requirements will have a tendency to develop more complete reports than were available in this instance, where advance notice of the data required had not been given.

Specimen Estimates Illustrating the Use of Composite Averages

By Henry L. Stortz

The Examples of Estimates presented herewith illustrate the plan of estimating and calculating Cost, using the Cost Engineering Methods as covered in the Manual, and the composite rates of cost and output shown in the preceding article, as compiled from the reports of Paper Box Factories using Denham Cost Engineering Systems throughout the United States.

It is the intention of the Joint Cost Committee in showing these estimates to encourage the adoption of the methods and principles illustrated as a basis for *uniformity* throughout the industry.

Material. No effort has been made to reconcile the prices of materials specified with the actual market. In the main the prices are approximately in accord with the present market, but a part of them may be arbitrary. The reader should endeavor to grasp the idea rather than the actual figures presented.

The specifications are normal. It must be understood that changes in specifications may materially change the cost. The cost of any item of material is necessarily governed by the price prevailing at the time the estimate is made, or upon the price paid for the material. As the manufacturer expects or hopes to stay in business and will have to replace his stock, the *material should never be figured at less than replacement value.*

Cost of Making. In calculating the cost of making in these estimates the average hourly costs and average hourly output rates shown in the Table of Composite Averages have been used as far as possible. However, where no output records have been reported or where such averages are impractical or inconsistent because either too high or too low for the type of box under consideration, the method of determining the time required to do the work or the output per hour, would be (if labor is paid by piecework) to ascertain the amount paid and divide by the average wage earned by the class of employees doing this work. This would show the number of hours or time the work may be estimated to require. If there are no output records, or no piecework prices available, on which to determine the approximate time, the estimator must be governed by his experience or judgment. If the estimator is not thoroughly familiar with the work, or is skeptical of his ability to accurately estimate the time required, consultation with the foreperson having supervision of the work in question is advised.

Quantities. It must be evident to the reader that the quantity to be produced will affect the cost of production. Small quantities will take relatively more time than large. The setting up and making ready for runs on machines will take the same time whether the lot to be run is one hundred, one thousand or ten thousand. The efficiency of the operator will be greater on the large runs. The difference in time of running will be much more apparent between the hundred and thousand lots than between the thousand and ten thousand lots. On quantities over ten thousand the difference will be less noticeable.

The estimates presented are for normal quantities of the style or size given. For example, the estimate on the One-pound Candy Box is figured on a ten thousand lot. If this box was figured on a one thousand lot the cost would be materially higher, because relatively more time would be required for setting up machines and running the smaller quantity.

Stock and Delivery Expenses. It is the opinion of the writer that the most practicable method of handling Stock and Delivery Expenses is to allocate them in two groups under the respective headings "Stock" and "Delivery".

All expense items connected with materials (not including board) such as interest on investment, insurance, storage expenses, etc., should be accumulated under the first heading, and at certain periods, quarterly, semi-annually, or annually, the total should be compared with the total cost of materials, and a percentage determined which should be included in the cost of materials applied in the estimates.

Under the heading "Delivery" should be allocated all of the expenses of delivery and the expenses in connection with the handling of board. These should be periodically prorated by percentage against the cost of board.

There will be instances where conditions will not permit these simple methods to be used. In such cases a careful study should be made to determine the best method. However, since there is no relation between the time or cost of the productive operations and the expenses of delivery and stock-handling, these expenses should never be included in the hourly operation costs.

Specimen Estimate on 100 Millinery Boxes

Specification: Size, 17x17x7. 1½" lid. Board equal to No. 45 chip 26x38. Flanges on box. Ends glued on and reinforced or corner pieced with 1¼" kraft. by hand turned in. Lids stayed ⅞" kraft. Box and lid covered grey cheviot. Lid trimmed with two strips, one 1¼" kraft turned in and one 1¼" kraft showing edge on lid. Two No. 17 white tapes pierced through sides and glued with paper tab. News bottoms. Label on lids, 3x6. Printed black.

HOW CUT

Boxes	Lids	Ends
17x17x7 1¼ 14	17x17x1½ 3¼ 3¼	17x7
18¼x31 2 1	20¼x20¼ 1 2	2 4
2 out Board No. 35 1/s 32x42	2 lids and 2 box ends Board No. 35 1/s 32x42	8 out Board No. 35 1/s 32x42

MATERIALS

Board in 100 Boxes	50 sheets No. 35 chip @ $60.00 ton, $4.29 per 100 sheets..			
Board in 100 Lids and Ends	50 sheets No. 35 chip @ 60.00 ton, 4.29 per 100 sheets..		$4.85	
Board in 100 Ends	13 sheets No. 35 chip @ 60.00 ton, 4.29 per 100 sheets..			
	113 sheets board cost			$4.85
Lining in	113 sheets 32 x42 1/s news, $1.00 per 100 sheets		$1.13	
Lining cost				1.13
Stay Paper for 100 Lids,	600 inches ⅞" kraft	$0.03½ per 1000 inches	$0.02	
Stay Paper for 100 Boxes	3600 inches 1¼" kraft, 35 lb.	.01 per 1000 inches	.04	
Trim Paper for 100 Boxes,	7600 inches 1¼" kraft	.01 per 1000 inches	.08	
Trim Paper for 100 Lids,	15200 inches 1¼" kraft	.01 per 1000 inches	.16	
Paper for 100 Boxes,	128 sheets Grey Cheviot 20x24	.50 per 100 sheets	.64	
Paper for 100 Lids,	32 sheets Grey Cheviot 20x24	.50 per 100 sheets	.16	
Paper for 100 Tops,	70 sheets Grey Cheviot 20x24	.50 per 100 sheets	.35	
Paper for 100 Bottoms,	70 sheets News	.20 per 100 sheets	.14	
Adhesive Gum and Paste on	300 sheets	.15 per 100 sheets	.45	
Adhesive Glue, for Ends			.20	
Tapes, No. 17 white, 100 yards		.10 per 100 yards	.10	
Labels, printed black, 1000 at a time		1.50 per 1000	.15	
	Paper and Sundry Material Cost			2.49
	Waste and Spoilage 5%			$8.47 .42
	Total Material Cost			$8.89

MAKING

	Boxes	Lids	Hour Output	Time Hour	Time Min.	Hour Rate		
Single Scorer, Setting up					20	$0.61	$0.20	
Single Scorer, 113 sheets			88	1	15	.61	.76	
Single Corner Cutter					10	.44	.08	
Paper Cutter					05	.80	.08	
Paper Slitter, 300 sheets			813		20	.68	.23	
	Total Cutting Cost							$1.35
Binding up	100	100			10	.46	.08	
Gluing On Ends (Girl's Hand Work)	100			2	30	.35	.88	
Corner Piecing (Girl's Hand Work)	100			1		.35	.35	
Single Stayer		100	472		15	.49	.13	
Strip Covering (2 strips)	100		80	1	15	.49	.62	
Strip Covering (3 strips)		100	100	1		.49	.49	
Top and Bottom Papering	100	100	200	1		.44	.44	
Taping (Girl's Hand Work)	100		40	2	30	.35	.88	
Labeling (Girl's Hand Work)		100	500		15	.35	.09	
Closing or Lidding Up					10	.34	.06	
	Making Cost							4.02
	Total Cost of Cutting and Making							5.37
	Total Cost per 100 Boxes							$14.26

Specimen Estimate on 1000 1-Pr. Ladies' Shoe Boxes

Specification: Size, 12x5x3¼. ⅞" Lid. Board approximately equal to No. 53, 26x38 chip lined 1/s news Covered friction white glaze, no edge. Lids stayed. Ends put on Single Ender. One end label printed one color (Black.) Bottom papered news. Tied in bundles of 25.

HOW CUT

Boxes	Lids	Ends
12 x5x3¼ 1¼ 6½	12 x5x⅞ 2⅛ 2⅛	5x3¼
13¼x11½ 3 2	14⅛x7⅛ 3 4	64 out
6 out Board, No. 50 1/s 26x40	12 out and 8 ends Board, No. 40 1/s 32²x44²	Board, No. 50 1/s 26x40

MATERIALS			
Board in 1000 Boxes, 167 sheets No. 50 chip @ $60.00 per ton—$3.00 per 100 sheets	$5.01		
Board in Ends 21 sheets No. 50 chip @ 60.00 per ton— 3.00 per 100 sheets	.63		
Board in 1000 Lids, 84 sheets No. 40 chip @ 60.00 per ton— 3.75 per 100 sheets	3.15		
272 sheets Board cost		$8.79	
Lining 172 sheets 1/s news 26x40 $0.80 per 100 sheets	1.38		
Lining 100 sheets 1/s news 32²x44² 1.10 per 100 sheets	1.10		
Lining Cost		2.48	
Stay Paper, ⅞" kraft, 4000 inches, 12½c lb., 3.5 per 1000 inches	$0.14		
Trim No.			
Edge No.			
Paper for Box, white glazed, 284 sheets 20x24 @ $2.00 per ream. $0.40 per 100 sheets			
Paper for Lid, white glazed, 120 sheets 20x24 @ 2.00 per ream .40 per 100 sheets			
Paper for Tops, white glazed, 125 sheets 20x24 @ 2.00 per ream, .40 per 100 sheets			
529 sheets 20x24 @ 2.00 per ream, .40 per 100 sheets	2.11		
Paper for Bottoms, News, 125 sheets 20x24 .20 per 100 sheets	.25		
Paper for Labels, Book, wht. 25 sheets 20x24 @ 2.00 per ream, .40 per 100 sheets	.10		
Adhesive Gum and Paste on 679 sheets 20x24 .15 per 100 sheets	1.01		
Printing, one color	1.00		
Tie Up Twine, for 40 bundles	.25		
Paper and Sundry Material Cost		4.86	
		$16.13	
Waste and Spoilage, 5%		.77	
Total Material Cost			$16.90

MAKING	Boxes	Lids	Hour Output	Time Hour	Time Min.	Hour Rate			
Single Scorer, Setting Up					30	$0.61	$0.31		
Single Scorer, 256 sheets			88	3		.61	1.83		
Double Corner Cutter, 1000 Pieces, Boxes			2000		30	.50	.25		
Single Corner Cutter, 1000 Pieces, Lids			2169		30	.44	.22		
Slitting Paper, 679 sheets			813		50	.68	.55		
Total Cutting Cost								$3.16	
Bending Up	1000	1000	1000	2		.46	.92		
Single Ender	1000		242	4		.60	2.40		
Single Stayer		1000	472	2		.49	.98		
Covering and Turning In	1000		243	3	30	.49	1.72		
Covering and Turning In		1000	243	3	30	.49	1.72		
Topping		1000	367	5		.44	2.20		
Bottom Papering	1000		367						
Finishing (Girl's Hand or Table Work) Label	1000		400	2	30	.35	.88		
Closing or Lidding Up	1000		500	2		.34	.68		
Making Cost								11.50	
Total Cost Cutting and Making									14.66
Total Cost per 1000 Boxes									$31.56

Specimen Estimate on 1000 12-Pr. Ladies' Hosiery Boxes

Specification: Size, 12x6x3. 1⅛" Lid. Board approximately equal to No. 60 26x38 chip lined 1/s News. Box and Lid stayed ⅞" Kraft. Box and Lid covered friction white glaze, colored glaze edge on lid. Two book white flies. One No. 17 White Tapes. Plain Tops. News Bottoms. One end label printed one color. Tied in bundles of 25.

HOW CUT

Boxes	Lids
12x6x3	12 x6x1⅛
6 6	2½ 2½
18x12	14½x8½
2 2	3 3
4 out	9 out
Board, No. 60 1/s 26x38	Board, No. 40 1/s 31²x44²

MATERIALS

Board in 1000 Boxes	250 sheets No. 60 chip @	$60.00 per ton =	$2.50 per 100 sheets.	$6.25	
Board in 1000 Lids	112 sheets No. 40 chip @	60.00 per ton =	3.75 per 100 sheets.	4.20	
	362 sheets Board Costs				$10.45
Lining in	250 sheets, 26x38 1/s News		$0.75 per 100 sheets	$1.88	
Lining in	112 sheets 31²x44² 1/s News		1.05 per 100 sheets	1.18	
	Lining Costs				3.06
Stay Paper, 1000 Boxes / 1000 Lids	18000 inches ⅞" Kraft, 12½ lb.,		$0.03.5 per 1000 inches	$0.63	
Trim No.					
Edge, Colored Glaze.	63 sheets 20x24 @		.50 per 100 sheets	.32	
Paper for Box,	white glaze, 334 sheets.				
Paper for Lids,	white glaze, 125 sheets.				
Paper for Tops,	white glaze, 167 sheets.				
	626 sheets 20x24 @		.40 per 100 sheets	2.50	
Paper for Bottoms—News	167 sheets 20x24 @		.20 per 100 sheets	.33	
Paper for Flies—Book White	200 sheets 20x24 @		.40 per 100 sheets	.80	
Paper for Labels—Book White	25 sheets 20x24 @		.40 per 100 sheets	.10	
Adhesive, Gum and Paste On	1081 sheets 20x24 @		.15 per 100 sheets	1.62	
Tapes, No. 17 White	900 yards		1.10 per 1000 yards	.99	
Printing Labels, 1 color				1.00	
Twine for 40 Bundles				.25	
	Paper and Sundry Material Cost				8.54
					$22.05
	Waste and Spoilage, 5%				1.10
	Total Material Cost				$23.15

MAKING

	Boxes	Lids	Hour Output	Time Hour	Time Min.	Hour Rate		
Single Scorer, Setting Up					20	$0.61	$0.20	
Single Scorer, 362 Sheets			88	4		.61	2.44	
Single Corner Cutter, 1000 Boxes and 1000 Lids			2169	1		.44	.44	
Paper Slitter, 1056 Sheets			813	1	30	.68	1.02	
Paper Cutter, 1000 Labels					05	.80	.08	
Total Cutting Cost								$4.18
Bending	1000	1000		3		.46	1.38	
Single Stayer	1000	1000	472	4	15	.49	2.08	
Strip Covering and Turning In	1000	1000	243	8		.49	3.92	
Top and Bottom Papering	1000	1000	367	5	30	.44	2.42	
Taping (Girl's Hand Work) 2 tapes	1000		200	5		.35	1.75	
Flying (Girl's Hand Work) 2 flies	1000		200	5		.48	2.40	
Labeling (Girl's Hand Work)	1000		335	3		.35	1.05	
Closing or Lidding Up	1000		500	2		.34	.68	
Making Cost								15.68
Total Cost of Cutting and Making								19.86
Total Cost per 1000 Boxes								$43.01

Specimen Estimate on 1000 ½-Doz. Shirt Boxes

Specification: Size, 18x11x3½. 1¼" Lids. From Board equal to No. 40, 31²x41² Plain News. Stayed Box and Lid ⅞" Kraft, no trim. covered Grey Cheviot, White Glaze edge on lid, one Lid Label printed one color. Plain Tops. No Bottoms. One tape laced through box to tie inside, not tied. Delivered loose by wagon.

HOW CUT

Boxes	Lids
18x11x3½	18x11x1¼
7 7	2¾ 2¾
25x18	20¾x13¾
1 2	2 2
2 out	4 out
Board, No. 50 Pl. News 26x38	Board, No. 45 Pl. News 31²x42²

MATERIALS

Board in 1000 Boxes	500 sheets, No. 50 Pl. News @ $65.00 per ton,	$3.25 per 100 sheets	$16.25		
Board in 1000 Lids,	250 sheets, No. 45 Pl. News @ 65.00 per ton,	3.61 per 100 sheets	9.02		
	750 sheets Board Cost			$25.27	
Stay Paper, 19,000 inches ⅞" Kraft — 12½ c lb.,		3.5 per 1000 in.	$0.67		
Trim No.					
Edge White Glaze,	100 sheets 20x26 @ $2.00 per ream,	.40 per 100 sheets			
Paper for Box—Cheviot	517 sheets 20x26 @ 2.00 per ream,	.40 per 100 sheets			
Paper for Lids—Cheviot	222 sheets 20x26 @ 2.00 per ream,	.40 per 100 sheets			
Paper for Tops—Cheviot	350 sheets 20x26 @ 2.00 per ream,	.40 per 100 sheets			
Paper for Labels—Book White	25 sheets 20x26 @ 2.00 per ream,	.40 per 100 sheets			
	1214 sheets 20x26 @ 2.00 per ream,	.40 per 100 sheets	4.86		
Adhesive Gum and Paste on 1214 sheets 20x26		.15 per 100 sheets	1.82		
Printing, 1000 Labels, one color			1.00		
Tapes, one 40"—1100 yards		.10 per 100 yards	1.10		
				9.45	
				$34.72	
Waste and Spoilage, 5%				1.74	
Total Material Cost					$36.46

MAKING	Boxes	Lids	Hour Output	Time Hour	Time Min.	Hour Rate			
Double Scorer, Setting Up					30	$0.67	$0.34		
Double Scorer, 750 Sheets			508	1	30	.67	1.01		
Single Corner Cutter, 2000 Pieces			2169	1	10	.44	.52		
Slitting Paper, 1214 Sheets			813	1	30	.68	1.02		
Total Cutting Cost								$2.89	
Bending Up	1000	1000		4		.46	1.84		
Single Stayer	1000	1000	472	4	15	.49	2.10		
Covering Box and Turning In	1000		150	7		.49	3.43		
Covering Lid and Turning In		1000	125	7	30	.49	3.68		
Topping		1000	200	5		.44	2.20		
Taping (Girl's Hand Work)	1000		200	5		.34	1.70		
Labeling (Girl's Hand Work)		1000	334	3		.34	1.02		
Lidding Up or Closing	1000			3		.35	1.05		
Making Cost								17.02	
Total Cost of Cutting and Making									19.91
Total Cost per 1000 Boxes									$56.37

Specimen Estimate on 10,000 1-lb. Candy Boxes

Specification: Size, 7⅜x3½x1¾. Telsc. Lid. Board equal to No. 80, 26x38 lined 1/s Book. Box and Lid stayed ⅞" Kraft. Box covered 1/s Litho. One piece S. & S. Lids loose wrapped. Litho printed tops. Two Laces in box. Packed in bundles of 50.

HOW CUT

Boxes	Lids
7⅜x3½x1¾	7⅜x3½x1¾
3½ 3½	3⅝ 3⅝
10⅞x7	11 x 7⅛
4 4	4 4
16 out	16 out
Board, No. 55 1/s Book 31²x44²	Board, No. 55 1/s Book 31²x44²

MATERIALS				
Board in Boxes	625 sheets No. 55 Chip @ $60.00 per ton, $2.73 per 100 sheets	$34.13		
Board in Lids,	625 sheets No. 55 Chip @ 60.00 per ton, 2.73 per 100 sheets			
	1250 sheets Board Cost		$34.13	
Lining in	1250 sheets 31²x44² 1/s Book @ $1.50 2.10 per 100 sheets	$26.25		
	Lining Cost		26.25	
Stay Paper, 140,000 inches ⅞" Kraft	.03.5 per 1000 inches	$4.90		
Paper for Box, Litho 1/s 24x36, 1120 Sheets	1.00 for 100 sheets	11.20		
Paper for Lids, Litho and Printed Tops	10.00 per 1000	100.00		
Flies, 2 Laces, 6667 Laces, 24"	1.20 per 1000	8.00		
Packing Paper, 200 Sheets Kraft 24x36	1.75 per 100 sheets	3.50		
Adhesive Glue for Boxes, 1120 Sheets 24x36,	.60 per 100 sheets	6.72		
Gum for Lids,	.40 per 1000	4.00		
Gum for Laces	.20 per 1000	2.00		
	Paper and Sundry Material Cost		140.32	
			200.70	
	Waste and Spoilage, 5%		10.04	
	Total Material Cost			$210.74

MAKING	Boxes	Lids	Hour Output	Time Hour	Time Min.	Hour Rate			
Double Scorer, Setting Up				1		$0.67	$0.67		
Double Scorer, 1250 Sheets			508	2	30	.67	1.68		
Single Corner Cutter, 20,000 Pieces			2169	9		.44	3.96		
Paper Cutter, 20,000 Laces					30	.80	.40		
Paper Cutter, Paper for 10,000 Boxes					30	.80	.40		
Stokes & Smith Corner Cutter Paper for 10,000 Boxes and Lids			10459	2		.90	1.80		
	Total Cutting Cost							$8.91	
			1000						
Bending	10000	10000	470	20		.46	$9.20		
Single Stayer	10000	10000		42		.49	20.58		
Stokes & Smith Machine, Setting Up			600	1		.99	.99		
Stokes & Smith Machine	10000		500	17		.99	16.83		
Stokes & Smith Machine, Loose Wrapp.		10000	483	20		.99	19.80		
Lacing	10000			20		.59	11.80		
Closing	10000			15		.34	5.10		
Packing 200 Bundles (Girl's Hand Work)	10000			10		.35	3.50		
	Making Cost							87.50	
	Total Cost of Cutting and Making								96.71
	Total Cost of 10,000 Boxes								$307.45
	Total Cost of 1,000 Boxes								30.75

Add for Cases and Crates as shipped.

Depreciation

The subject of depreciation is admitted to be one in which there is considerable difference in the practice followed by the industry. The committee therefore considered it advisable to establish Uniform Rates of depreciation and for this reason a "Questionnaire" was sent out to the subscribers to collect data showing the rates of depreciation that were being used, and from the data collected, after careful consideration of the subject, the committee makes the following recommendations:

That for the purpose of furthering the movement for uniformity the following rates be adopted. The depreciation to be made from the original cost of the item—at a yearly percentage:

	Per Cent
Buildings, brick	2
Buildings, frame	3
Boilers	8
Engines	8
Motors	8
Elevators	8
Power transmission	10
Cutting machinery	10
Scorers	10
Slitters	10
Corner cutters	10
Paper cutters	10
Sheet cutters	10
Slotters	10
S. & S. Corner cutters	10
Balers	10
Liners	10
Stayers	10
Wire stitchers	10
Metal edge stayers	10
Flange benders	10
Covering machines	7
Topping machines	7
Thumb holding machines	7
Gumming machine	7
S. & S. wrapping machine	12
S. & S. stencil machine	12
S. & S. gluing machine	12
S. & S. lacing machine	12
Flying machine	12
Necking machine	12
Quadruple stayer	12
Enders	12
Hand work equipment	6
Tables	6
Glue pots, brushes	6
Pony covering machine	6
Shears	6
Round and oval cutters	6
Glue mixers	6
Trays	6
Fixtures and utensils	6
Hand trucks	6
Tape winders	6
Machine shop equipment	10
Saws	10
Shelving	25
Printing Dept.	
Platen presses	15
Cylinder presses	10
Bronzing machines	10
Cutting and creasing press	8
Embossing presses	8
Punching presses	8
Type equipment	33⅓
Electros	33⅓
Cuts	33⅓
Delivery Dept.	
Wagons	20
Horses	20
Motor trucks	33⅓

JOINT COST COMMITTEE,
National Federation Paper Box Manufacturers Association,
HENRY L. STORTZ, Secretary.

Rules and Regulations of Box Board Manufacturers Association

Effective June 1, 1916

The following Rules and Regulations were adopted by the Box Board Manufacturers Association and comprise all the necessary information for ordering various grades of board, the object being to eliminate and correct mistakes of custom and practice and as far as possible to standardize the grades manufactured.

DEFINITIONS AND RULES

For Figuring Box Board

Bundle—A Bundle of box board is a standard package of same weighing 50 lbs. The weight of a bundle does not vary.

Number—The "Number" of board indicates the number of sheets, size 26 x 38, in a bundle weighing 50 lbs.

Count—By "Count" is meant the number of sheets of any size in a bundle of 50 lbs.

Regular Size—The Regular or Standard Size of all grades of board, except Patent Coated and Solid Manila, adopted for the United States is 26 x 38, containing 988 square inches.

The Regular or Standard Size of Patent Coated and Solid Manila Board is 24 x 36, containing 864 square inches.

Regular Number—The Regular Number indicates the number of sheets, 26 x 38 in size, in a bundle of 50 lbs.

To Determine Count of Odd Size Sheets—If not sure of the Regular Number of the board desired, determine same by Gauge List. Divide the number of square inches in a bundle of the regular number desired, by the square inches in the special size sheet desired, and the result is the "count" or "number" of the special size desired.

To Determine Regular Number of Any Special Size—Knowing the count of the special size, multiply the square inches in special size sheet by the count, the result being the square inches in the bundle. Divide the square inches of the special size by the square inches in a regular sheet ($26 \times 38 = 988$), and the result is the "regular number."

Basis of Gauge Lists—The size referred to in all the Gauge Lists, excepting Patent Coated and Manila Boards, is the regular size 26 x 38, containing 50 lbs. to the bundle.

The gauge list and ream weights of Patent Coated and Manila Boards is based on the ream, 24 x 36, 500 sheets.

DIRECTIONS FOR ORDERING

If purchasers will follow these directions it will greatly assist in giving the best possible service, without delays and errors.

Quantity—State quantity of each item desired, and if special size, weight or grade is ordered, the maximum and minimum quantity acceptable should be given (see reservations Nos. 6 and 8). The quantity should not be less than one ton of each item. It is necessary to have orders for at least five tons of any special grade.

Size—In all cases, whether ordering regular stock or special sizes, state sizes wanted in inches (see reservation No. 9). When ordering roll stock, give width of roll in inches; also maximum and minimum diameter, and the size and kind of center.

Weight or Thickness—Specify the number of sheets wanted of the size ordered in each 50-lb. bundle, or the weight per ream or the caliper thickness. If the special size which may be ordered is to be made on the basis of a regular number or weight, state that fact clearly. If in doubt about the number, weight or thickness desired, send a sample showing exactly what is wanted (see reservation No. 6).

Kind and Quality—State clearly the kind and quality desired, using the names of the several grades referred to in this book. If in doubt as to the name of the grade desired, send sample showing what is wanted.

Finish—In all cases indicate the finish desired. When no specifications of finish are given it is customary to ship medium finish, except that Manila board, combination and other folding box boards will be made with the regular high finish unless specified otherwise.

Grain—Unless instructed to the contrary, the grain of Sheet board will be made the way of the last specification of the size, i. e., 26 x 38 would indicate the grain to run the 38-inch way, and 38 x 26 would indicate the grain to run the 26-inch way. Whenever grain may run either way, that fact should be noted on the order.

Special Requirements—State clearly all special requirements for each item, and when convenient describe any unusual or special use for which the product is wanted.

Colors—Always submit sample showing color desired (see reservation No. 10).

Shipping Instructions—Give name of consignee and destination. Mills reserve the right to route all goods sold at delivered prices. Give date of shipment desired.

For shipments to points in any territory where arbitrary or local freight rates are charged, such additional charges will be added to the price quoted for deliveries in said territory.

RESERVATIONS

All orders accepted are subject to the following reservations:

1. Prices quoted are subject to change without notice.

2. Orders are not subject to cancellation or changes after acceptance without written consent.

3. Orders should always be in the form of specifications of quantity, sizes and weights or count, with a date for shipment. Specifications may be changed if provided for when order is placed, and if stock has not been made.

4. All promises of shipment are made subject to the unforeseen or unavoidable delays, either at mills or while in transit.

5. No claims, allowances or damages will be entertained unless reported on arrival of goods and before using any portion thereof.

6. The manufacturer does not agree to make the exact caliper, count or basis of weight ordered, but reserves the minimum variation of five per cent either way in both count and caliper, and in no case less than one point in thickness.

7. The Manufacturer does not guarantee surface measurement of box board made in rolls.

8. Orders for special sizes, weights, colors or grades will be accepted on the following conditions:

For quantities of—

Five	tons or less, a variation either way, 25% in amount
Ten	tons or less, a variation either way, 20% in amount
Fifteen	tons or less, a variation either way, 15% in amount
Twenty	tons or less, a variation either way, 10% in amount

9. Quotations for all Box Boards and special products are based on cutting off at the end of the machine to approximate length, and shipping in unprotected bundles, unless otherwise specified herein. The Manufacturer will furnish such sizes so cut that exact size specified may be trimmed from the sheet furnished. Squaring, trimming, or special packing must be clearly specified, for which an extra charge is made.

10. The Manufacturer does not undertake to exactly match any shade or color of any product he makes, but will duplicate colors and shades as nearly as possible, in the grade of product to be colored.

11. The Manufacturer does not guarantee board for clay coating mill work in quality, finish, thickness, waste or folding strength, after coating. The acceptance of the stock by the Coating Mill is considered an acceptance by the purchaser.

TERMS

All accounts are due net in thirty days from date of shipment.

Two per cent cash discount if paid within fifteen days from date of shipment.

Any freight deductions made are conditional on the surrender of paid expense bills.

EXTRA CHARGES

All quotations for Box Boards are made subject to extra charges for the following items except when otherwise clearly stated:

Rolls narrower than 10 inches	per ton	$------
Sheets narrower than 10 inches or shorter than 20 inches	per ton	------
Re-cutting or squaring	per ton	------
Re-winding	per ton	------
Waterproofing	per ton	------
Hard sizing (one side)	per ton	------
Banding or sealing	per ton	------
Casing	per ton	------
Crating	per ton	------
Strapping (cases or crates)	per ton	------
Framing	per ton	------
Extra for cores		------

Burlapping, baling and other special packing quoted on application.

EXTRA CHARGES ON STRAW BOARD

Single Feather Edge	$------
Double Feather Edge	------
White News Mill Lining	------
White News Sheet Lining	------
Manila and Colored News (Mill or Sheet Lining)	------

EXTRA CHARGES ON PLAIN CHIP—SOLID JUTE

White News Mill Lining	$------
White News Sheet Lining	------
Manila and Colored (Mill or Sheet Lining)	------
Book Lining	------
Oak Graining	------
Marble Graining	------
Cedar Graining	------

The above grade is finished fifty pounds to the bundle, tied with two strings; if finished in reams, or side and end wrapped with four strings, an additional charge will be made.

FORM OF UNIFORM ORDER BLANK FOR BOX BOARDS

Recommended by the Box Board & Paper Committee of the Western Paper Box Manufacturers Association.

ORDER BLANK FOR BOXBOARDS

To _____ Order No. _____

_____ Date _____ 191__

_____ Ship Via _____

Ship to _____ When to Ship _____

_____ Terms _____

_____ F.O.B. _____

Tons	Bundles	Size	Basis 26 x 38	Count	Caliper	Finish	Kind of Board and Lining	Price

Signed _____

The grain must run the way of the second size. No change may be made without our consent.

Remarks: _____

_____

_____

Where our members know what the basis is and the count also, they will please put it down in columns 4 and 5.

The word "Count" at the top of the fifth column means the number of sheets that you expect to a bundle.

If you know the basis that you wish the board and you don't know how many sheets it should count to the bundle, don't put anything down under "count."

It is not absolutely necessary to put anything in the column under the word "Caliper," but you should always do so under "Finish."

Paper Trade Customs

GLAZED AND FANCY PAPER MANUFACTURERS ASSOCIATION

1. All prices are to be based for paper in rolls on the ream of 500 sheets of the following standard sizes, viz:

Ordinary Glazed, Plated and Printed Papers, basis 20″ x 24″.

Ex. Fine Glazed, Waterproof Finished and Embossed, basis 20″ x 25″.

2. *Standard Rolls. Widths*—Ordinary Glazed, Plated and Printed Papers, 24″ or 26″ wide.

Ex. Fine Glazed, Waterproof Finished and Embossed 25″ wide.

Contents—Glazed, Plated, Printed or any flat surfaced paper not weighing over 30 lbs. to ream 20″ x 24″. Not less than 3 reams to a roll.

Weighing over 30 lbs. to ream 20″ x 24″. Not less than 2 reams to a roll.

All papers with embossed surface. Not less than 1 ream to a roll.

3. *Extra Charges for Sheeting, Slitting, etc.*

(a) Sheeting case lots or more 15c per ream base sizes.
Sheeting less case lots 25c per ream base sizes.

Other sizes in proportion.

(b) Slitting in reels not less than 25c per ream base sizes.

(c) All orders for special sizes to be cut or slit from stock rolls, must be arranged to consume entire contents of a roll or rolls.

4. Special colors and qualities. The minimum quantity to be accepted at regular rates to be equal to 25 reams 20″ x 24″ or 20″ x 25″. If less than 25 reams there shall be an advance in price, depending upon cost of production.

5. On all special runs the usual normal variations in quality and shade shall be accepted. Such orders shall be subject to overruns or underruns as follows:

Orders of 25 to 49 reams.....25%
Orders of 50 to 99 reams.....20%
Orders of 100 reams and over.....10%

and deliveries so made shall be considered as an execution of the order.

6. Special prices for exceptional quantities shall not apply to small quantities, or ream prices for broken lots from stock; in quoting prices for case lots, a case lot shall be 25 reams of the base size or its equivalent.

7. All claims must be made within ten days from receipt of goods. No claims will be allowed on goods changed from the condition in which they were delivered.

8. All goods shipped at buyer's risk. Express and parcel post deliveries, to be at cost of the receiver.

9. All "make and hold" orders must specify an ultimate date for shipment, at which date goods are to be billed and the in-

voices taken to account by customer whether ordered shipped or not.

10. Terms, 3% for cash, being payment in thirty days, net 31 days.

11. Prices and quotations subject to change without notice. All orders, contracts, and agreements, are contingent upon strikes, fires, accidents or causes beyond our control.

FORM OF UNIFORM ORDER BLANK FOR PAPER

Recommended by the Box Board and Paper Committee of Western Paper Box Manufacturers Association.

ORDER BLANK FOR PAPER

To _____ Order No._____

_____ Date _____ 191_

_____ Ship Via_____

Ship to _____ When to Ship_____

_____ Terms_____

_____ F.O.B._____

No. of Reams Rolls	Color	Kind	Design	Your No.	Our No	Size of Sheet	Width of Roll	Price	Basis

Remarks:_____

Signed_____

Safe Short Cuts in Estimating

A Paper by W. C. Carlson

In preparing this paper on Safe Short Cuts in Estimating, I will endeavor to touch on several things that I consider are in connection and essential to safe short cuts. So vital and important is the matter of accurate estimating that it ought to receive the best attention of every manufacturer. There should be no room for guesswork, as it is deceiving and often disastrous. In order to estimate accurately, the estimator must have practical knowledge of how a box is to be constructed, also know thoroughly every manufacturing operation and detail. Without this knowledge, an estimator is working under great difficulty. Very often the estimator is merely a man of figures and has little or no conception of practical boxmaking and does not know the proper and just prices to set for piecework operations. These great varieties of operation can only be well and accurately estimated by a man of tact, experience and expert judgment. In order to have an estimating system produce safe short cuts, it is essential to have an estimating sheet that is perfect in every detail. It must bear every operation of labor and every item of material. A complete estimate blank is a safe short cut, as it reminds you to get in every operation and all material connected with a job. The estimating blank should be printed so as to eliminate all writing possible. Print every detail that is likely to be needed in estimating any style box or job, or have a different set of estimate blanks for each different class of boxes. By doing this it saves the estimator a lot of writing that could be just as well embodied and printed on the estimate. In these short cuts I wish to say a few words regarding filing estimates for quick and handy reference. There are a few ways they can be handled so as to consume the least possible time in filing and handling.

Sometimes they are often referred to and if they can be readily located it will save a lot of time. In my opinion, an estimate should not be made more than one on a sheet, and not in a bound book, as I believe some handle them. An individual estimate blank, in my opinion, is the quickest and safest. A loose leaf book is not advisable, for the reason that often two or three people in the office will want to refer to an estimate on different jobs at the same time. Having more than one estimate on a sheet has its faults, owing to many estimates becoming obsolete, and in time it means an endless time to recopy and transfer. You not only have to copy the dead ones, but the live ones have to be transferred also. A card system for filing estimates is an excellent one, properly arranged in alphabetical order and with individual pockets for a firm when there are quantities

of them. For good and handy reference, a system of filing boxes to fit the estimate blanks from A to Z, is a quick way to file, placing a clip on each firm's lot. If filed in this manner, a separate file should be arranged for the different grades of boxes; that is, a folding box should not be filed with estimates on set up boxes. In many cases a customer uses several kinds of different grades, and if filed separately it eliminates a lot of time and is a short cut in picking out the estimates wanted. The estimator should have a copy of the sizes of all presses and a list of the minimum and maximum sizes of boxes or sheets that each machine or press will handle, instead of having to get this information each time from delayed sources. The estimator should also have an index book containing all up-to-date buying prices on all material. In many cases the estimator also does the buying, but when the buying and estimating is done by two separate persons, then safe short cuts cannot be done without the estimator consulting the buyer many times a day, inquiring from the buyer the cost of different materials.

With an index purchasing book at his disposal, properly kept up, it's a short cut for him and a time saver to the buyer. The estimator should also be equipped with a card index on which to keep a record of all piecework rates and test runs. Also cost sheet information taken from actual runs. This not only helps the estimator to make a safe estimate, but it is a big time saver and assures accuracy. He should know the approximate weight per ream of all kinds of paper, so as to add the freight to the buying price. The paper varies quite a little in different weights: Bronze Glazed runs about 22 pounds to the ream; White Linen, 44; Double Coated White, 37, and Skytogens approximately 29 pounds. He should also have a copy of the freight and express rates from points where material is purchased. He should be equipped with calculating books and tables to eliminate all unnecessary figuring when a table will produce results wanted instantly.

I have here several short cut estimating tables and books. Anyone may inspect them if they wish. I refer you to a set of tables published by the Shears, of Lafayette, Ind. One gives the cost of strawboard per hundred sheets; another gives the cost for a hundred sheets of paper; the third one gives average table for strawboard. These three tables are handy references for any estimator. I am also pleased to refer you to a book sold by the American Boxmaker, of Chicago, price of which I believe is $30. This book is called the "Calcule." This book is very complete, giving many sets of tables. Estimating tables for costs and selling prices are not printed in calcule for obvious reasons, but a half dozen methods or helpful hints could be demonstrated in

five minutes, showing calcule to be almost indispensable in this work. When stock is bought right and received with care, there always remains the countless number of times when it must be known: What is the count of a slightly different size or weight sheet? What is the weight per thousand sheets or ream? What is the weight per thousand square feet? I believe Mr. Hoy is here at the Convention, and no doubt he will be glad to explain the merit of this rapid calculating book to any who are interested. I also have here for inspection the Proportionate Weight Calculator, which is sold by the District of Columbia Paper Manufacturers, of Washington, D. C., price of which is $5. It is an aluminum chart that very rapidly gives you the count of special sizes of board and also the special sizes of paper. It has been verified a great many times and found to be absolutely correct. This device saves a great amount of figuring where you are using special sizes, and ought to be of great assistance to any paper box man.

For the inspection of our members I have here style No. 520, Burroughs Adding Machine, price of which is $150. This machine is a very handy article for the estimator to have on his desk. It's a great help and convenience. An estimate to be safe should be totaled on an adding machine. It also multiplies and subtracts.

This machine will add and subtract. I believe Mr. Pike, who represents the Burroughs Adding Machine, is here and will be glad to demonstrate to any of the members. He claims if a box man figures below cost, the entire machine will immediately turn red. Here is a small adding machine, which is called the Calcumeter 8-dial, price of which is $25, sold by Herbert North Morse, of Trenton, N. J., absolutely accurate, light in weight and consumes hardly any room at all on the desk. Any of these articles that I have shown you will short-cut estimating.

In estimating, short cuts should be used wherever practicable, as without them estimating would consume an endless amount of time. Most anyone with a good knowledge of mathematics has many fixed rules to follow, the amount of these varying with the ability of the individual. One often finds great use for safe short cuts, as sometimes a box is so constructed that it requires in the neighborhood of fifty separate calculations to acquire the cost of the material, to say nothing of the labor items. Anyone who does a great deal of figuring, whether in estimating or in other classes of work, will agree that the first rudiments in rapid calculation are to reduce your figures to as small units as possible. Thus, in beginning, if we commence with board, it is far easier to get the cost of a given number of sheets by using cost per sheet instead of per bundle or per ton. By this means many

a cost can be figured mentally. Take, for instance: Sixty sheets, count 50 board at $24 per ton. If you stop to figure what proportion this amount of board is of the bundle or of the ton, it will take two separate calculations to arrive at the cost. By reducing the cost to so much a sheet, in this case, we simply multiply cost—.012 (twelve thousandths) by 60, which gives us 72c.

In using these fractional costs per unit in arriving at cost of larger quantities much time can be saved by the following method. For example: 295 sheets at .012 cost $2.95, plus 59, which equals 43.54. This result is obtained by taking the sum and adding 1-5c of itself, as .012 equals 1 1-5c. This method can always be used to advantage where the cost does not go over 3 or 4 cents and a fraction per unit.

In figuring cost of papers, as a general rule, on all ream papers of any consequence, the easiest way is to figure by cost per 100 sheets. This is a good short cut in figuring paper for boxes that are finishing on the stripping and topping machines, with which a good many are no doubt familiar. After arriving at the total square inches of paper necessary to strip box, cover and also top, multiply this sum by two, which gives us the amount of sheets needed per 1,000. In using this form, care must be exercised in allowing for turn in on box and cover, and also a fixed percentage for waste, which is always far greater in roll than in sheet stock. On a great many kinds of cheap paper a fixed rate per M can be used in arriving at cost of material. Print and book papers, for bottom labeling, for corners, trimming and for reinforcement, it is a very good plan and time saver to figure cost of paper at so much per square inch per M.

Cloth trim, hinges and corners should also be estimated in this manner. Of course, we know that nearly all costs are derived by multiplication. It is here that the estimator can use his knowledge to advantage. Some men can multiply by double figures almost as rapidly as by single. This naturally comes from practice, but there are innumerable ways to eliminating multiplication, which, as all will agree, is the slowest process. Here are a few examples: If 424 sheets cost 75c per C, to find cost quickly, deduct 1/4 of 424 from this amount, which leaves $3.18 as cost. To prove this, let me explain that by figuring this paper at $1 per C, sheets would cost $4.24. As 75c is 1/4 less than $1, by deducting $1.06 (1/4) from $4.24, you can arrive at your answer in quick fashion. The same rule can be applied in different fractions with time saving results. There is an old rule we used to learn in school which reads, "To multiply by 25, divide by 100 and then multiply by 4." This bears out my argument of reducing to small units at every chance that arises. Take this one: If paper cost 95c per C, or board 95c per bundle, and you

have the amount of stock necessary, instead of multiplying by 95c, simply take the difference between 95c and $1, which is 5c, and use this for arriving at your cost. There are two short cuts available here. Paper at 95c costs 5 per cent less than $1 paper; to find the cost of 640 sheets deduct 5 per cent, or 32, from 640. The other way to get results quickly is to consider 5 per cent as 1/20. Deduct 1/20, or 32, from 640, and you have your answer, and both these operations should be done mentally and consume but a fraction of time.

One member informs me that he handles some of his estimates in this manner: "I use fixed rates. For instance: My cases at 1½c per cu. ft. Staying on 1-pound box, 75c per thousand. This would include bundling, handling, waste material, etc. This is for single staying only. For S. & S. work, instead of dividing the operations and accounting for each one separately, I include the gluing, feeding, bundling and handling, making a fixed rate which embraces all the operations, varying according to size of box." This may be a short cut, but doubtful if it is accurate and safe.

Another member writes me as follows: "For instance, I never think of figuring the board and lining paper as two separate items. A sheet lined board at $24 per ton, on the basis of 60, is figured at 84c per bundle. Glazed paper is figured on the square inch basis on the roll, rather than to figure the pieces used for a box, and then figure out how many sheets 20 x 24 inches are required. Instead of figuring the lid paper separate from the box paper, it is figured together; that is, if the box requires 20 inches in length and 3 inches in width and the lid 1½ inches in width, then you simply find how many square inches are to be used by multiplying the length by the width of the two strips aggregating 4½ inches in width. This is also true of glue. We know that so many pounds of a certain grade of glue will cover so many square inches; hence when we have the number of sheets required to make up 1,000 boxes, we know how much glue is required also. Stay material we have figured on the basis of so much per thousand inches, so you see it is very simple to know how much the stay material would cost on 1,000 boxes, knowing the number of inches of stay material required."

Many short cuts can be gotten up by each member if they will only devote a little time and study to them, which will fit their particular need and which will save much time, and frequently much labor, too. No doubt a great many of you have done the same as I have, and that is to figure out thousands of times a year how much lace, cambric corners and cloth hinges it takes for a thousand boxes, and the cost of it. That is certainly a waste of good valuable time.

I have prepared a few charts showing the cost of lace for a box 5 inches, 7 inches, or any other length. The only thing that will change the price on this chart is the change of your purchase price of lace per thousand strips. This, of course, will need attention.

Price List on Lace by the inch per M boxes 2 lace in Box

No. Lace	Width Lb.	Length	PRICE PER M STRIPS	3"	3½"	4"	4½"	5	5½"	6	6½"	7"	7½"	8"	8½"	9"	9½"	10"	10½"	11"	11½"
506	½	22½"	.45	.13	.15	.18	.18	.23	.23	.30	.30	.30	.30	.45	.45	.45	.45	.45	.45	.45	.45
514	1	22½"	.60	.18	.20	.24	.24	.30	.30	.40	.40	.40	.40	.60	.60	.60	.60	.60	.60	.60	.60
350	½	23"	.70	.20	.24	.28	.28	.35	.35	.47	.47	.47	.47	.70	.70	.70	.70	.70	.70	.70	.70
355	1	23"	.75	.21	.25	.30	.30	.38	.38	.50	.50	.50	.50	.75	.75	.75	.75	.75	.75	.75	.75
360	2	23"	1.10	.32	.37	.44	.44	.55	.55	.74	.74	.74	.74	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
544	2	23"	.80	.23	.27	.32	.32	.40	.40	.54	.54	.54	.54	.80	.80	.80	.80	.80	.80	.80	.80
552	5	23"	1.05	.30	.35	.42	.42	.53	.53	.70	.70	.70	.70	1.05	1.05	1.05	1.05	1.05	1.05	1.05	1.05

The first column is the manufacturer's number of lace. Second column, width of lace for half, one, two and five pound manufacturer's number, with the note whether they are open or linen lace. Next column is the length of the lace that strips come in, and there is the price per 1,000 strips. If you want lace for a thousand boxes, No. 566, on a half-pound box 7½ inches long, the chart shows you it will cost 30 cents. If you want No. 355, on a 1-pound box 7½ inches long, it will cost 50 cents; the same number on a 3-inch box will cost 21 cents. You will note that from 8-inch to 11½-inch price does not vary. That is on account of 8-inch not cutting well into 22½-inch. You can see there is a large waste. If you have something that you can cut the waste into, you can make allowance for it if you wish. The 5-inch costs $1.05, the 4-inch costs 42 cents, 11½-inch, $1.05. This table once figured out will stop all future figuring. We have done it. We have figured dozens and dozens of times on the same size until adopting this method.

The same principle applies to cambric corners or hinges. It is absolutely unnecessary to keep figuring these items over and over again, possibly several times in one day.

CLOTH HINGES	4"	5"	6"	7"	8"	9"	10"	11"	12"
1" WIDE	.36	.45	.54	.63	.72	.81	.90	.99	1.08
1¼ WIDE	.45	.56	.68	.79	.90	1.01	1.13	1.25	1.35
1½ WIDE	.54	.68	.81	.95	1.08	1.22	1.35	1.49	1.62

Another chart, which will apply to Manilla hinges and corners—this is especially handy if boxes are cornered by hand for boxes too deep for stayers.

MANILLA CORNERS	5"	6"	7"	8"	9"	10"
1" WIDE	.18	.22	.25	.29	.32	.36
1¼" WIDE	.23	.27	.32	.36	.41	.45

For figuring bottom labels of print paper a square inch table is quick and accurate. This table, however, should be used for figuring roll paper only.

Chart for print papers 3 cents per pound 26-inch roll. If you have a box 5 x 6 to equal 30 square inches, paper will cost 10 cents. On a box 4 x 11 to equal 44 square inches, paper will cost 15 cents. This chart is for roll paper only. If you make a chart, it should be worked out 35, 40, 45, 50, and so on.

Bottom Label-Print Paper

COST PER M BOXES

PRICE PER LB.	Size	30 SQU. IN.	44 SQU. IN.	69 SQU. IN.	86 SQU. IN.
.03	26" ROLL	.10	.15	.23	.29

FOR ROLL PAPER ONLY

In many cases the estimator makes out the orders for the factory, or it is done under his supervision. It is quite a job to transfer all figures necessary from an estimate blank to the factory order, and here is where a short cut saves a lot of time. Some boxmakers that I know copy nearly the entire estimate every time the job is entered on repeat orders. This is a large waste of time, and also gives chance for errors in copying.

Here is a factory order blank that once made out properly never has to be recopied as long as the size and specifications remain the same as originally figured. All that is necessary is to write in the date, order number and quantity to be run.

Box 16 x 8
Cover 14½ x 6 1/16
Size of Layer x

ORDER

Size of Tray x x Number of Box 721
Customer Brown Size 12 x 4 x 2 Cover 1/8 Ply 3/16 x 3/16

		DATE	ORER NO.	AMT.	COVER = $.90 COLOR	BOX = $.80	DEPT.
Box No. 30 PL 30x47 Sheets ~~and Ends~~		1/27	875	5000	Red Gla-Bla-S		
Cover No. 30 PL 30 x 42 Sheets and Ends							
Ends No. PL x Sheets							
Tray No. PL x Sheets							
Part No. PL x Sheets							
Inner No PL x Sheets							
Neck No. x Sheets							
Set up Box Ends Cloth Paper Wrap	30						
Set up Box Ends Cloth Inner Wrap	30						
Set up Box Ends Cloth Inner Wrap							
Cover Box	80						
Cover Cover							
Tape by Machine	60						
Tape by Hand							
Bottom by Machine	30						
Bottom by Hand							
Inside Label							
Label Box							
Label Cover							
Sheeting							
Inner Pad							
Pin Set							
Nail							
Tape Inner Box							
Tape Inner							
Stay Wood Ends							
Nail Wood Ends	70						
Clip on Blanks							
Stay Pads							
Position Set Up							
Position Clip On							
Inserts							
Pads							
Wood Pegs							
Stay Wood							
Clip on Wood	40						
Pegs Bottom Stay							
Pegs Bottom Clip On							
Pegs							
Pegs Hole							
Clayton	30						
Wrapping							

This factory order blank should bear each operation of labor. Also each item of material that is on your estimate. This column is for your labor piecework prices. These columns are for your board. If a repeat order comes in, all that is necessary is to insert the date, order number and quantity to be run. It only takes a half a minute to enter. I haven't all the items printed in on account of the fact that every firm would probably want a different form. Piecework prices are all on here, and, remember, they are exactly the same as they are on your estimate. That is where a good many go wrong. When the piecework prices are all on here they never change, and it is up to your foreman to see that those prices are paid to the help. You figure one price in the office and the factory is paying another. You also have the play size, which once correct, always remains.

You have got the size blank of your box and cover, which is very handy for the cutter. Any employee in your factory without any of this wording can tell immediately what these abbreviations mean. It only takes very little time for employees, both in the office and in the factory to get acquainted with them, and they can read them just as quickly as the stenographer can read her shorthand.

When the first order is entered your cutters and foremen are given all the information needed; nothing is lacking. Play of cover, size and grade of board and paper. It also bears all piecework prices to be paid to hand and machine workers. This is truly a safe short cut.

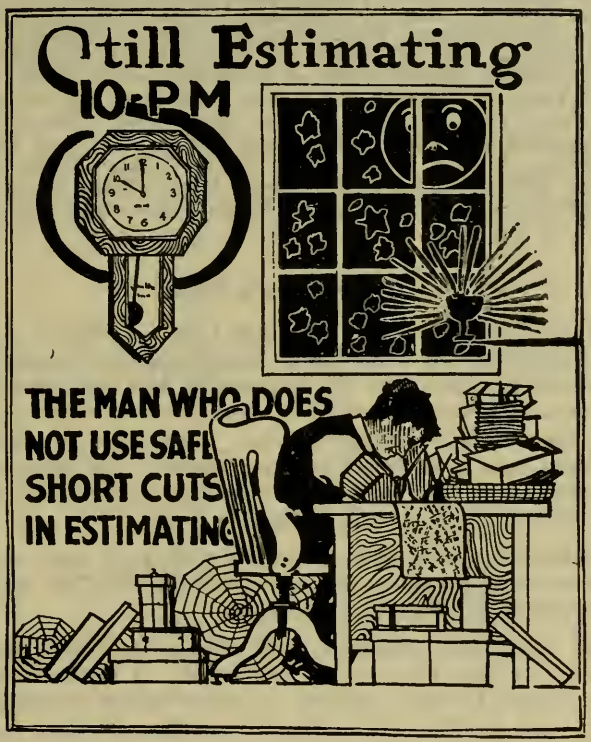
A good many of you use cloth corners and hinges. I have only a little piece of this chart figured out, because none of you have anything to do when you get home, and you can figure it yourself. Cloth corners or hinges, cloth 24 x 36 at 6 cents a yard for 1,000 boxes 8 x 1, costs $1.12. You will note on this chart I have the cloth figured out in inches. Also one and a quarter inches. Charts can be figured out so as to make any width desired, also any length. Manila chart is on the same order as the cloth, $2.50 per ream, size 30 x 42, 1,000 boxes 4 inches deep, cost 9 cents, 8 inches deep cost 16 cents, 6 inches, 14 cents.

I may be getting a little off my subject, but I wish to show and explain some short cuts in abbreviation of words that are written thousands of times a day in paper box factories, not only by the estimator, but by your foremen, cost and bill clerks. These can be used to very good advantage, and you will be surprised how readily your employees will be able to cipher the meaning of them.

Here is a drawing of a boxmaker who does not use any safe short cuts in estimating. He prefers to stay in his office until 10

o'clock at night figuring by old methods, while the more progressive boxmakers are home with their families—maybe.

In closing, I wish to tell a story I heard a short time ago. This story explains a short cut in estimating, but it is not a safe short cut. Two Jews started in the paper box business—Ikey and Abe. Ikey was a practical boxmaker, while Abe was not. So Ikey with his experience took the running of the shop and Abe went out on the street soliciting business. Things ran along for a while without making any money; in fact, their funds were vanishing. So Ikey went to his banker and tried to negotiate a small loan. The banker asked him several questions and also wanted to know how they were getting along. He told the banker that they were getting along better the last few weeks since they had made a change, as he was now to do the soliciting and Abe was to run the shop. The banker could not quite see this, and told Ikey, inasmuch as he was a practical man, his place was to run the shop, and Ikey explained: "Vell, I'm a better guesser than Abe—Abe was a rotten guesser." Gentlemen, I thank you.


Still Estimating
10 P.M
THE MAN WHO DOES
NOT USE SAFE
SHORT CUTS
IN ESTIMATING

PART II

Committee's Note—Gauge Lists—Ream Weight Tables—Equalization Tables for Box Boards—Shears' Quick Calculating Average Tables for Strawboard—Rules for Finding Count of Coated Board—Weight and Cost of Coated Board—Cost of Board per 100 Sheets, Nos. 10 to 120, at from $20 to $90 Per Ton—Tables Showing Cost of Sheet Lining per Sheet at from 40 Cents to $1.75 Per Hundred Sheets—Paper Equivalent Tables—The Equivalentor—Slide Rules—Quick Paper Rules—Strip Paper Table—Table Showing Cost Per Hundred Sheets of Paper—Shears' Estimating Tables—Proportionate Ream Prices—Cost of Paper Per 1000 Square Inches—Cost of Paper, 20 x 24 Per Ream, Per 1000 Square Inches, and Per Sheet—Cost of Trim Paper Per 1000 Running Inches—Cost of Gummed Kraft Per 1000 Running Inches—Stay Paper Required Per 1000 Boxes or Lids—Strip Cutting Tables—Cost Per 1000 Running Inches Strip Paper—Cost per 1000 Running Inches Muslin Strips—Box Twine Table—Table Showing Cost Per 1000 Running Inches Metal Edge—Table Showing Cost Per 1000 Running Inches Metal Stitch Wire—Glue and Gums—Waste and Spoilage.

Committee's Note

In the following pages the Joint Cost Committee of the National Federation of Paper Box Manufacturers Association has endeavored to present to the Paper Box Making Industry, such information and data as has been considered of value and assistance to the estimator in figuring cost. The tables have been compiled from data contributed by the members and from all available sources and the committee takes this opportunity of thanking the contributors for the assistance given.

These tables have been compiled with great care and a vast amount of time given to the work, but infallibility can not be assured, no responsibility is assumed.

The committee, however, will appreciate being notified of any errors so that they can be corrected. It is the intention of the committee to have editions of these tables reprinted from time to time together with the revised Hourly Cost Rates and Hourly Output Rates, and all information and additions that may be of service to the industry, and further the general adoption of the Uniform Estimating and Cost Finding Methods.

It will probably be found convenient to have extra copies of these tables for the estimator's quick reference.

Should sufficient demand develop, the committee will have printed extra copies of the tables that will be sold at a nominal charge, so that the estimator can have them in convenient form.

JOINT COST COMMITTEE.
HENRY L. STORTZ, Secretary.

Gauge List No. 1

FOR PLAIN STRAW AND PLAIN CHIP BOARDS

Solid Jute, dry finish; Filled Wood Pulp, Filled News Board, Single News Vat Lined Chip and Single White Vat Lined Chip.

Basis 26 x 38	No. 1 Finish Thick to No. and Rough	No. 2 Finish Medium	No. 3 Finish Thin to No. and Smooth	No. 4 Finish Extra Smooth
No. 35	.064	.060	.057	.051
No. 40	.056	.053	.050	.045
No. 45	.050	.047	.045	.040
No. 50	.045	.042	.040	.036
No. 55	.041	.038	.036	.033
No. 60	.038	.035	.033	.030
No. 65	.035	.032	.030	.028
No. 70	.032	.030	.028	.026
No. 75	.030	.028	.027	.024
No. 80	.028	.026	.025	.023
No. 85	.026	.024	.023	.022
No. 90	.025	.023	.022	.020
No. 95	.024	.022	.021	.019
No. 100	.022	.020	.019	.018
No. 110	.020	.019	.018	.017
No. 120	.018	.017	.016	.015
No. 130	.017	.016	.015	.014
No. 140	.016	.015	.014	.013
No. 150	.015	.014	.013	.012

Arranged by the Box Board Manufacturers Association.

Gauge List No. 2 for

Cracker Shell Board
Plain Shell Board, colored one side
Colored Box Board, Chip Back
Colored Box Board, Chip Center, News Back
Any Combination Board with Solid News Back
Any Combination Board with Solid Wood Back
Single Manila Lined Chip
Single Manila Lined Chip Center News Back
Bleached Manila Lined Chip
Bleached Manila Lined Chip Center News Back
Double Manila Lined Chip and Manila Colored Shell
Colored Suit Box Board Chip Back
Colored Suit Box Board Chip Center News Back
Mist Colored Suit Box Board Chip Back
Mist Colored Suit Box Board Chip Center News Back
Test Jute
Test Chip Board
Jute Lined Chip Board
Jute Lined Chip Board News Back
Imitation Jute
Filled Jute (Chip Center)
Solid Jute (Bending)

Basis 26 x 38	No. 1 Finish Thick to No. and Rough	No. 2 Finish Medium	No. 3 Finish Thin to No. and Smooth	No. 4 Finish Extra Smooth
No. 40	.050	.047	.045	.043
No. 45	.045	.043	.041	.038
No. 50	.040	.038	.036	.034
No. 55	.037	.035	.033	.031
No. 60	.034	.032	.030	.028
No. 65	.031	.030	.028	.026
No. 70	.029	.028	.026	.024
No. 75	.027	.026	.024	.023
No. 80	.025	.024	.023	.021
No. 85	.024	.023	.022	.020
No. 90	.023	.022	.020	.019
No. 95	.022	.020	.019	.018
No. 100	.020	.019	.018	.017
No. 105	.019	.018	.017	.016
No. 110	.018	.017	.016	.015
No. 120	.017	.016	.015	.014
No. 130	.016	.015	.014	.013
No. 140	.015	.014	.013	.012
No. 150	.014	.013	.012	.011

Arranged by the Box Board Manufacturers Association.

Gauge List No. 3

For Solid News and Solid Wood Pulp Board

Basis 26 x 38	No. 1 Finish Thick to No. and Rough	No. 2 Finish Medium	No. 3 Finish Thin to No. and Smooth	No. 4 Finish Extra Smooth
No. 40	.063	.060	.055	.050
No. 45	.056	.054	.050	.045
No. 50	.050	.048	.044	.040
No. 55	.046	.044	.040	.036
No. 60	.042	.040	.037	.033
No. 65	.039	.037	.034	.031
No. 70	.036	.034	.031	.029
No. 75	.033	.032	.029	.027
No. 80	.031	.030	.027	.025
No. 85	.029	.028	.026	.023
No. 90	.028	.026	.024	.022
No. 95	.026	.025	.023	.021
No. 100	.025	.024	.022	.020
No. 110	.022	.021	.020	.019
No. 120	.021	.020	.019	.018
No. 130	.020	.019	.018	.017
No. 140	.019	.018	.017	.016
No. 150	.018	.017	.016	.015

Gauge List No. 4

For Pasted Chip Board

Basis 26 x 38	No. 1 Finish Medium	No. 2 Finish Thin to No. and Smooth	No. 3 Finish Extra Smooth
No. 10	.212	.200	.180
No. 15	.142	.133	.120
No. 18	.113	.111	.100
No. 20	.106	.100	.090
No. 22	.096	.090	.082
No. 25	.085	.080	.072
No. 28	.076	.071	.064
No. 30	.070	.067	.060
No. 35	.060	.057	.051

Arranged by the Box Board Manufacturers Association.

Gauge List No. 5

CONTAINER BOARD

Basis 26 x 38	No. 3 Finish	Test
No. 15	.120	300 Lbs.
No. 18	.100	275 Lbs.
No. 23	.080	200 Lbs.
No. 29	.060	175 Lbs.

Furnished in 2, 3 or 4 Ply Pasted and conforms to Railway and Express requirements.

Arranged by the Box Board Manufacturers Association.

Gauge List No. 6 and Ream Weight Table

FOR PATENT COATED—CHIP BACK; PATENT COATED—NEWS BACK; PATENT COATED—NEWS CENTER MANILA BACK; PATENT COATED—SOLID MANILA BACK; PATENT COATED—BLUE BACK; SOLID MANILA BOARD.

Caliper Thickness	Basis 500 Sheets 24 x 36 (864 sq. in.) Lbs.	Basis 500 Sheets 25 x 40 (1,000 sq. in.) Lbs.
.011	154	178
.012	168	194
.013	182	210.60
.014	189	217.60
.015	195	225.69
.016	208	240.70
.017	221	255.78
.018	230	266.20
.019	238	274.88
.020	245	283.56
.021	252	291.66
.022	264	305.55
.023	276	319.44
.024	288	333.33
.025	300	347.21
.026	312	361.10
.027	324	374.99
.028	336	388.88
.029	348	402.77
.030	360	416.65

Furnished wrapped in reams or half-ream bundles.

Rules for Figuring Weight of Odd Sizes

Use the decimal table above, which is on the basis of 1,000 sq. inches and is accurate. First find the square inches in the sheet wanted and multiply same by the decimal in 25 x 40 table above, then point off decimals and you will have the correct weight of the odd size per ream. EXAMPLE—22 x 34.018 Patent Coated. 22 x 34 = 748 sq. in. x 260.14 lbs. = 195 pounds per ream.

Arranged by the Box Board Manufacturers Association.

Ream Weight Table

For White Mill Blanks

Gauge	Plies	Weight per 100 Sheets Size 22 x 28 Lbs.
.015	3	140
.018	4	160
.021	5	180
.024	6	205
.030	8	260
.036	10	300

3 Ply to 5 Ply, inclusive, are wrapped in sealed packages of 100 sheets.

6 Ply and heavier are wrapped in sealed packages of 50 sheets.

Five packages are packed in a bundle not framed.

Regular size, 22 x 28, carried in stock. Also 28 x 44.

Special sizes and thicknesses will be made in lots of 5,000 sheets to order.

Special sizes are packed without sealed wrapping, in bundles, not framed.

Arranged by the Box Board Manufacturers Association.

Handy Tables of Box Board Equivalents

EQUALIZATION TABLE

26 x 38	26½ x 39	29 x 42	31 x 41	31½ x 41½	32 x 44	32½ x 44½
25	24	20	19	19	18	17
30	29	24	23	22½	21	20½
35	33½	28	27	26½	25	24
40	38	32	31	30	28	27
45	43	36	35	34	32	31
50	48	40	39	38	35	34
55	53	44	43	41	39	37½
60	57	49	47	45	42	41
65	62	53	51	49	46	44
70	67	57	54	53	49	48
75	72	61	58	57	53	51
80	76½	65	62	60	56	54½
85	81	69	66	64	60	58
90	86	73	70	68	63	61
95	91	77	74	72	66	65
100	95½	81	78	75	70	68
110	105	89	86	83	77	75
120	115	97	93	90	84	82

Arranged by Philip Rudolph & Sons, Philadelphia.

EQUALIZATION TABLE

31 x 39			31 x 41			29 x 42		
No. 20 =	25	regular	No. 20 =	25	regular	No. 20 =	25	regular
25 =	30	"	25 =	32	"	25 =	30	"
30 =	37	"	30 =	38	"	30 =	37	"
35 =	43	"	35 =	45	"	35 =	43	"
40 =	49	"	40 =	51	"	40 =	49	"
45 =	55	"	45 =	58	"	45 =	55	"
50 =	61	"	50 =	64	"	50 =	61	"
55 =	67	"	55 =	70	"	55 =	67	"
60 =	73	"	60 =	77	"	60 =	74	"
65 =	80	"	65 =	83	"	65 =	80	"
70 =	85	"	70 =	90	"	70 =	86	"
75 =	92	"	75 =	96	"	75 =	92	"
80 =	98	"	80 =	103	"	80 =	98	"
85 =	104	"	85 =	109	"	85 =	104	"
90 =	110	"	90 =	115	"	90 =	110	"
95 =	116	"	95 =	122	"	95 =	117	"
100 =	122	"	100 =	128	"	100 =	124	"

Contributed by Henry L. Stortz.

Complete set of Quick Calculating Average Tables for strawboard can be secured from Shears Publishing Co., Lafayette, Ind.

Coated Board

To find the number or count of a bundle 24 x 36—50 lbs.—ascertain the number of points or caliper standard box gauge.

Rule:

$$\frac{\text{No. points} \times 2.5}{5000} = \begin{cases}\text{Count of board} \\ \text{in 1 bundle of} \\ \text{24 x 36—50 lbs.}\end{cases}$$

This is on the basis of 24 x 36—500 sheets to ream; 12½ lbs. to the point.

To find number of points or caliper standard gauge coated board.

Rule: (Having the number or count of a bundle 24 x 36—50 lbs.):

$$\frac{5000 \div \text{No. or count}}{2.5} = \begin{cases}\text{No. points 24 x 36.} \\ \text{500 sheets to ream.} \\ \text{12½ lbs. to point.}\end{cases}$$

The weight of 100 sheets coated board = No. of points × 2.5.

$$\text{The count of 50 lb. bundle 24 x 36} = \frac{5000}{\text{Weights of 100 sheets}}$$

$$\text{The count of 50 lb. bundle 24 x 36} = \frac{5000}{\text{No. points} \times \text{weight per point}^2}$$

$$\text{The count of 50 lb. Bdle. 26x38} = \frac{5000}{\text{No. Pts.} \times \text{wgt. per point}^2\text{—143\% or 1/7 approximately}}$$

$$\text{The count of 50 lb. bundle, any size} = \frac{5000}{\text{No. Pts.} \times \text{weight per point}^2 \text{ —difference between surface of 24 x 36 (864) \& size of sheet}}$$

To find count of 50 lb. bundle, any size.

This rule of proportion may be used:

Rule: $\underset{\text{Surface of 24 x 36}}{864} : \frac{5000}{\text{No. Pts.} \times 2.5} : : \text{Surface of sheet} : \underset{\text{Desired Size}}{\text{Count.}}$

Contributed by Henry L. Stortz.

Coated Board

WEIGHT AND COST PER 1000 SHEETS 28x44 CLAY COATED AND PATENT WHITE BOARD FROM 12 TO 20 POINTS THICK AT FROM 2 TO 4 CENTS PER POUND

PRICE PER POUND

Pt.	Wt.	2	2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞	3	3⅛	3¼	3⅜	3½	3⅝	3¾	3⅞	4
12	428	$ 8.56	9.10	9.63	10.17	10.70	11.24	11.77	12.31	12.84	13.38	13.91	14.45	14.98	15.52	16.05	16.59	17.12
13	464	9.28	9.86	10.44	11.02	11.60	12.18	12.76	13.34	13.92	14.50	15.08	15.66	16.24	16.82	17.40	17.98	18.56
14	499	9.98	10.61	11.23	11.85	12.48	13.10	13.72	14.35	14.97	15.60	16.22	16.84	17.47	18.09	18.71	19.34	19.96
15	535	10.70	11.37	12.04	12.71	13.38	14.05	14.71	15.38	16.05	16.72	17.39	18.06	18.73	19.40	20.06	20.73	21.40
16	571	11.42	12.14	12.85	13.56	14.28	14.99	15.69	16.42	17.13	17.85	18.56	19.27	19.99	20.70	21.41	22.13	22.84
17	606	12.12	12.88	13.64	14.39	15.15	15.91	16.67	17.42	18.18	18.94	19.70	20.45	21.21	21.97	22.73	23.48	24.24
18	642	12.84	13.64	14.45	15.25	16.05	16.85	17.66	18.46	19.26	20.06	20.87	21.67	22.47	23.27	24.08	24.88	25.68
19	678	13.56	14.41	15.26	16.10	16.95	17.80	18.65	19.49	20.34	21.19	22.04	22.88	23.73	24.58	25.43	26.27	27.12
20	713	14.26	15.15	16.04	16.94	17.83	18.72	19.61	20.50	21.39	22.28	23.17	24.07	24.96	25.85	26.74	27.63	28.52

Arranged by G. N. Snyder, Grand Rapids, Mich.

Board Table, Giving Cost of 100 Sheets from No. 10 to 120 and from $20 to $90 per Ton

No. of Board .	10	12	14	15	16	18	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120
No. Sh's to Ton	400	480	560	600	640	720	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4400	4800
Cost per Ton	COST PER 100 SHEETS																								
$20.00	5.00	4.17	3.57	3.33	3.13	2.78	2.50	2.00	1.67	1.43	1.25	1.12	1.00	.91	.84	.77	.72	.67	.63	.59	.56	.53	.50	.46	.42
21.00	5.25	4.38	3.75	3.50	3.28	2.92	2.63	2.10	1.75	1.50	1.32	1.17	1.05	.96	.88	.81	.75	.70	.66	.62	.59	.56	.53	.49	.44
22.00	5.50	4.58	3.93	3.67	3.44	3.06	2.75	2.20	1.84	1.58	1.38	1.23	1.10	1.00	.92	.85	.79	.74	.69	.65	.62	.58	.55	.50	.46
22.50	5.63	4.69	4.02	3.75	3.52	3.13	2.81	2.25	1.88	1.61	1.41	1.25	1.13	1.02	.94	.87	.80	.75	.70	.66	.63	.59	.56	.51	.47
23.00	5.75	4.79	4.11	3.83	3.59	3.19	2.88	2.30	1.92	1.65	1.44	1.28	1.15	1.05	.96	.89	.83	.77	.72	.68	.64	.61	.58	.53	.48
24.00	6.00	5.00	4.29	4.00	3.75	3.33	3.00	2.40	2.00	1.72	1.50	1.34	1.20	1.10	1.00	.93	.86	.80	.75	.71	.67	.64	.60	.55	.50
25.00	6.25	5.21	4.46	4.17	3.91	3.47	3.13	2.50	2.09	1.79	1.57	1.39	1.25	1.14	1.05	.97	.90	.84	.79	.74	.70	.66	.63	.57	.53
26.00	6.50	5.42	4.64	4.33	4.06	3.61	3.25	2.60	2.17	1.86	1.63	1.45	1.30	1.19	1.09	1.00	.93	.86	.82	.77	.73	.69	.65	.60	.55
27.00	6.75	5.63	4.82	4.50	4.22	3.75	3.38	2.70	2.25	1.93	1.69	1.50	1.35	1.23	1.13	1.04	.97	.90	.85	.80	.75	.71	.68	.62	.57
27.50	6.88	5.73	4.92	4.58	4.30	3.82	3.44	2.75	2.29	1.96	1.72	1.53	1.38	1.25	1.15	1.06	.98	.92	.86	.81	.76	.72	.69	.63	.58
28.00	7.00	5.83	5.00	4.67	4.38	3.90	3.50	2.80	2.34	2.00	1.75	1.56	1.40	1.28	1.17	1.08	1.00	.94	.88	.83	.78	.74	.70	.64	.59
29.00	7.25	6.04	5.18	4.83	4.53	4.03	3.63	2.90	2.42	2.08	1.82	1.62	1.45	1.32	1.21	1.12	1.04	.97	.91	.86	.81	.77	.73	.66	.61
30.00	7.50	6.25	5.36	5.00	4.69	4.17	3.75	3.00	2.50	2.15	1.88	1.67	1.50	1.37	1.25	1.16	1.08	1.00	.94	.89	.84	.79	.75	.69	.63
31.00	7.75	6.46	5.54	5.17	4.84	4.31	3.88	3.10	2.59	2.22	1.94	1.72	1.55	1.41	1.30	1.20	1.11	1.04	.97	.92	.87	.82	.78	.71	.65
32.00	8.00	6.67	5.71	5.33	5.00	4.44	4.00	3.20	2.67	2.29	2.00	1.78	1.60	1.46	1.34	1.24	1.15	1.07	1.00	.95	.89	.85	.80	.73	.67
32.50	8.13	6.77	5.80	5.42	5.08	4.51	4.06	3.25	2.71	2.33	2.04	1.81	1.63	1.48	1.36	1.25	1.17	1.09	1.02	.97	.91	.86	.82	.74	.68
33.00	8.25	6.88	5.89	5.50	5.16	4.58	4.13	3.30	2.75	2.36	2.07	1.84	1.65	1.50	1.38	1.27	1.18	1.10	1.04	.98	.92	.87	.83	.75	.69
34.00	8.50	7.08	6.07	5.67	5.31	4.72	4.25	3.40	2.84	2.43	2.13	1.89	1.70	1.55	1.42	1.31	1.22	1.14	1.07	1.00	.95	.90	.85	.78	.71
35.00	8.75	7.29	6.25	5.83	5.47	4.86	4.38	3.50	2.92	2.50	2.19	1.95	1.75	1.60	1.46	1.35	1.25	1.17	1.10	1.03	.98	.93	.88	.80	.73
36.00	9.00	7.50	6.43	6.00	5.63	5.00	4.50	3.60	3.00	2.58	2.25	2.00	1.80	1.64	1.50	1.39	1.29	1.20	1.13	1.06	1.00	.95	.90	.82	.75
37.00	9.25	7.71	6.61	6.17	5.78	5.14	4.63	3.70	3.09	2.65	2.32	2.06	1.85	1.69	1.55	1.43	1.33	1.24	1.16	1.09	1.03	.98	.93	.85	.78
37.50	9.38	7.81	6.70	6.25	5.86	5.21	4.69	3.75	3.13	2.68	2.35	2.09	1.88	1.71	1.57	1.45	1.34	1.25	1.18	1.11	1.05	.99	.94	.86	.79
38.00	9.50	7.92	6.79	6.33	5.94	5.28	4.75	3.80	3.17	2.72	2.38	2.13	1.90	1.73	1.59	1.47	1.36	1.27	1.19	1.12	1.06	1.00	.95	.87	.80
39.00	9.75	8.13	6.96	6.50	6.09	5.42	4.88	3.90	3.25	2.79	2.44	2.17	1.95	1.78	1.63	1.50	1.40	1.30	1.22	1.15	1.09	1.03	.98	.90	.82
40.00	10.00	8.33	7.14	6.67	6.25	5.56	5.00	4.00	3.34	2.86	2.50	2.23	2.00	1.82	1.67	1.54	1.43	1.34	1.25	1.18	1.12	1.06	1.00	.91	.84
41.00	10.25	8.54	7.32	6.83	6.41	5.69	5.13	4.10	3.42	2.93	2.57	2.28	2.05	1.87	1.71	1.58	1.47	1.37	1.29	1.21	1.14	1.08	1.03	.94	.86
42.00	10.50	8.76	7.50	7.00	6.56	5.84	5.26	4.20	3.50	3.00	2.63	2.34	2.10	1.91	1.75	1.62	1.50	1.40	1.32	1.24	1.17	1.11	1.05	.96	.88

Board Table, Giving Cost of 100 Sheets from No. 10 to 120 and from $20 to $90 per Ton—Continued

No. of Board .	10	12	14	15	16	18	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120
No.Sh's to Ton.	400	480	560	600	640	720	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4400	4800
Cost per Ton	COST PER 100 SHEETS																								
$42.50	10.63	8.86	7.59	7.09	6.65	5.91	5.32	4.25	3.55	3.04	2.66	2.37	2.13	1.94	1.78	1.64	1.52	1.42	1.33	1.25	1.19	1.12	1.07	.97	.89
43.00	10.75	8.96	7.68	7.17	6.72	5.97	5.38	4.30	3.59	3.08	2.70	2.39	2.15	1.96	1.80	1.66	1.54	1.44	1.35	1.28	1.20	1.14	1.08	.98	.90
44.00	11.00	9.16	7.86	7.34	6.88	6.12	5.50	4.40	3.67	3.15	2.75	2.45	2.20	2.00	1.84	1.70	1.58	1.47	1.38	1.30	1.23	1.17	1.10	1.00	.92
45.00	11.25	9.38	8.04	7.50	7.03	6.25	5.63	4.50	3.75	3.22	2.82	2.50	2.25	2.05	1.88	1.73	1.61	1.50	1.41	1.33	1.25	1.19	1.13	1.03	.94
46.00	11.50	9.58	8.22	7.66	7.18	6.38	5.76	4.60	3.83	3.29	2.88	2.56	2.30	2.10	1.92	1.77	1.65	1.54	1.44	1.36	1.28	1.22	1.15	1.05	.96
47.00	11.75	9.79	8.39	7.83	7.34	6.53	5.88	4.70	3.92	3.36	2.94	2.62	2.35	2.14	1.96	1.81	1.68	1.57	1.47	1.39	1.31	1.24	1.18	1.07	.98
47.50	11.88	9.90	8.48	7.92	7.42	6.60	5.94	4.75	3.96	3.40	2.97	2.64	2.38	2.16	1.98	1.83	1.70	1.59	1.49	1.40	1.32	1.25	1.19	1.08	.99
48.00	12.00	10.00	8.58	8.00	7.50	6.66	6.00	4.80	4.00	3.43	3.00	2.67	2.40	2.19	2.00	1.85	1.72	1.60	1.50	1.42	1.34	1.27	1.20	1.10	1.00
49.00	12.25	10.21	8.75	8.17	7.66	6.81	6.13	4.90	4.09	3.50	3.07	2.73	2.45	2.23	2.05	1.90	1.75	1.64	1.54	1.45	1.37	1.30	1.23	1.12	1.03
50.00	12.50	10.42	8.93	8.33	7.81	6.94	6.25	5.00	4.17	3.58	3.13	2.78	2.50	2.28	2.09	1.93	1.79	1.67	1.57	1.48	1.39	1.32	1.25	1.14	1.05
51.00	12.75	10.63	9.11	8.50	7.97	7.08	6.38	5.10	4.25	3.65	3.19	2.84	2.55	2.32	2.13	1.97	1.83	1.70	1.60	1.50	1.42	1.35	1.28	1.16	1.07
52.00	13.00	10.84	9.28	8.66	8.12	7.22	6.50	5.15	4.34	3.72	3.25	2.89	2.60	2.37	2.17	2.00	1.86	1.74	1.63	1.53	1.45	1.37	1.30	1.19	1.09
52.50	13.13	10.94	9.38	8.75	8.20	7.29	6.56	5.20	4.38	3.75	3.28	2.92	2.63	2.39	2.19	2.02	1.88	1.75	1.64	1.54	1.46	1.38	1.31	1.20	1.10
53.00	13.25	11.04	9.46	8.83	8.28	7.36	6.63	5.30	4.42	3.79	3.32	2.95	2.65	2.41	2.21	2.04	1.90	1.77	1.66	1.56	1.48	1.40	1.33	1.21	1.11
54.00	13.50	11.26	9.64	9.00	8.44	7.50	6.76	5.40	4.50	3.86	3.38	3.00	2.70	2.46	2.25	2.08	1.93	1.80	1.69	1.59	1.50	1.43	1.35	1.23	1.13
55.00	13.75	11.46	9.82	9.17	8.59	7.64	6.88	5.50	4.59	3.93	3.44	3.06	2.75	2.50	2.30	2.12	1.97	1.84	1.72	1.62	1.53	1.45	1.38	1.25	1.15
56.00	14.00	11.66	10.00	9.34	8.76	7.80	7.00	5.60	4.67	4.00	3.50	3.13	2.80	2.55	2.34	2.16	2.00	1.87	1.75	1.65	1.56	1.48	1.40	1.28	1.17
57.00	14.25	11.88	10.18	9.50	8.91	7.92	7.13	5.70	4.75	4.08	3.57	3.17	2.85	2.60	2.38	2.20	2.04	1.90	1.79	1.68	1.59	1.50	1.43	1.30	1.19
57.50	14.38	11.98	10.27	9.58	8.98	7.99	7.19	5.75	4.79	4.11	3.59	3.19	2.88	2.61	2.40	2.21	2.05	1.92	1.80	1.69	1.60	1.51	1.44	1.31	1.20
58.00	14.50	12.08	10.36	9.66	9.06	8.06	7.26	5.80	4.84	4.15	3.63	3.23	2.90	2.64	2.42	2.24	2.08	1.94	1.82	1.71	1.62	1.53	1.45	1.32	1.21
59.00	14.75	12.29	10.54	9.83	9.22	8.19	7.38	5.90	4.92	4.22	3.70	3.28	2.95	2.69	2.46	2.27	2.11	1.97	1.85	1.74	1.64	1.56	1.48	1.35	1.23
60.00	15.00	12.50	10.71	10.00	9.38	8.33	7.50	6.00	5.00	4.29	3.75	3.34	3.00	2.73	2.50	2.31	2.15	2.00	1.88	1.77	1.67	1.58	1.50	1.37	1.25
61.00	15.25	12.71	10.89	10.17	9.53	8.47	7.63	6.10	5.09	4.36	3.82	3.39	3.05	2.78	2.55	2.35	2.18	2.04	1.91	1.80	1.70	1.61	1.53	1.39	1.28
62.00	15.50	12.92	11.08	10.34	9.68	8.62	7.76	6.20	5.17	4.43	3.88	3.45	3.10	2.82	2.59	2.39	2.22	2.07	1.94	1.83	1.73	1.64	1.55	1.41	1.30
62.50	15.63	13.02	11.16	10.42	9.77	8.68	7.81	6.25	5.21	4.46	3.91	3.47	3.13	2.84	2.60	2.40	2.23	2.08	1.95	1.84	1.74	1.65	1.56	1.42	1.31
63.00	15.75	13.13	11.25	10.50	9.84	8.75	7.88	6.30	5.25	4.50	3.94	3.50	3.15	2.87	2.63	2.43	2.25	2.10	1.97	1.86	1.75	1.66	1.58	1.44	1.32
64.00	16.00	13.34	11.42	10.66	10.00	8.88	8.00	6.40	5.34	4.58	4.00	3.56	3.20	2.91	2.67	2.47	2.29	2.14	2.00	1.89	1.78	1.69	1.60	1.46	1.34

Board Table, Giving Cost of 100 Sheets from No. 10 to 120 and from $20 to $90 per Ton—Continued

No. of Board .	10	12	14	15	16	18	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120
No. Sh's to Ton.	400	480	560	600	640	720	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200	3400	3600	3800	4000	4400	4800
Cost per Ton	COST PER 100 SHEETS																								
$65.00	16.25	13.54	11.61	10.83	10.16	9.03	8.13	6.50	5.42	4.65	4.07	3.62	3.25	2.96	2.71	2.50	2.33	2.17	2.04	1.92	1.81	1.72	1.63	1.48	1.36
66.00	16.50	13.76	11.78	11.00	10.32	9.16	8.26	6.60	5.50	4.72	4.13	3.67	3.30	3.00	2.75	2.54	2.36	2.20	2.07	1.95	1.84	1.74	1.65	1.50	1.38
67.00	16.75	13.96	11.96	11.17	10.48	9.31	8.38	6.70	5.59	4.79	4.19	3.73	3.35	3.05	2.80	2.58	2.40	2.24	2.10	1.98	1.87	1.77	1.68	1.53	1.40
67.50	16.88	14.08	12.06	11.25	10.55	9.38	8.44	6.75	5.63	4.83	4.22	3.75	3.38	3.07	2.82	2.60	2.41	2.25	2.11	1.99	1.88	1.78	1.69	1.54	1.41
68.00	17.00	14.16	12.14	11.34	10.62	9.44	8.50	6.80	5.67	4.86	4.25	3.78	3.40	3.10	2.84	2.62	2.43	2.27	2.13	2.00	1.89	1.79	1.70	1.55	1.42
69.00	17.25	14.38	12.32	11.50	10.78	9.58	8.63	6.90	5.75	4.93	4.32	3.84	3.45	3.14	2.88	2.66	2.47	2.30	2.16	2.03	1.92	1 82	1.73	1.57	1.44
70.00	17.50	14.58	12.50	11.67	10.94	9.72	8.75	7.00	5.84	5.00	4.38	3.89	3.50	3.19	2.92	2.70	2.50	2.34	2.19	2.06	1.95	1.85	1.75	1.60	1.46
71.00	17.75	14.79	12.68	11.83	11.09	9.86	8.88	7.10	5.92	5 08	4.44	3.95	3.55	3.23	2.96	2.73	2.54	2.37	2.22	2.09	1.98	1.87	1.78	1.62	1.48
72.00	18.00	15.00	12.86	12.00	11.26	10.00	9.00	7.20	6.00	5.14	4.50	4.00	3.60	3.28	3.00	2.77	2.58	2.40	2.25	2.12	2.00	1.90	1.80	1.64	1.50
72.50	18.13	15.13	12.95	12.09	11.33	10.07	9.07	7.25	6.05	5.18	4.54	4.03	3.63	3.30	3.03	2.79	2.59	2.42	2.27	2.13	2.01	1.91	1.81	1.65	1.51
73.00	18.25	15.21	13.04	12.17	11.41	10.14	9.13	7.30	6.09	5.22	4.57	4.06	3.65	3.32	3.05	2.81	2.61	2.44	2.29	2.15	2.03	1.93	1.83	1.66	1.53
74.00	18.50	15.42	13.22	12.34	11.56	10.28	9.26	7.40	6.17	5.29	4.63	4.13	3.70	3.37	3.10	2.85	2.65	2.47	2.32	2.18	2.06	1.95	1.85	1.69	1.55
75.00	18.75	15.63	13.39	12.50	11.72	10.42	9.38	7.50	6.25	5.36	4.70	4.17	3.75	3.41	3.14	2.90	2.68	2.50	2.35	2.21	2.09	1.98	1.88	1.71	1.57
76.00	19.00	15.84	13.58	12.66	11.88	10.56	9.50	7.60	6.34	5.43	4.75	4.23	3.80	3.46	3.19	2.93	2.72	2.54	2.38	2.24	2.12	2.00	1.90	1.73	1.60
77.00	19.25	16.04	13.75	12.83	12.03	10.69	9.63	7.70	6.42	5.50	4.82	4.28	3.85	3.50	3.23	2.97	2.75	2.57	2.41	2.28	2.14	2.03	1.93	1.75	1.61
78.00	19.50	16.26	13.92	13.00	12.18	10.84	9.76	7.80	6.50	5.58	4.88	4.34	3.90	3.55	3.28	3.00	2.79	2.60	2.44	2.30	2.17	2.06	1.95	1.78	1.63
79.00	19.75	16.46	14.11	13.17	12.34	10.97	9.88	7.90	6.59	6.65	4.94	4.39	3.95	3.60	3.32	3.04	2.83	2.64	2.47	2.33	2.20	2.08	1.98	1.80	1.65
80.00	20.00	16.67	14.29	13.33	12.50	11.11	10.00	8.00	6.67	5.72	5.00	4.45	4.00	3.64	3.37	3.08	2.86	2.67	2.50	2.36	2.23	2.11	2.00	1.82	1.67
81.00	20.25	16.88	14.46	13.50	12.66	11.25	10.13	8.10	6.75	5.79	5.07	4.50	4.05	3.69	3.41	3.12	2.90	2.70	2.54	2.39	2.25	2.14	2.03	1.85	1.69
82.00	20.50	17.08	14.64	13.66	12.82	11.38	10.26	8.20	6.84	5.86	5.13	4.56	4.10	3.73	3.46	3.16	2.93	2.74	2.57	2.42	2.28	2.17	2.05	1.87	1.71
83.00	20.75	17.29	14.82	13.83	12.97	11.53	10.38	8.30	6.92	5.93	5.19	4.62	4.15	3.78	3.50	3.20	2.97	2.77	2.60	2.45	2.31	2.19	2.08	1.90	1.73
84.00	21.00	17.52	15.00	14.00	13.12	11.67	10.52	8.40	7.00	6.00	5.25	4.67	4.20	3.82	3.55	3.24	3.00	2.80	2.63	2.48	2.34	2.22	2.10	1.91	1.75
85.00	21.25	17.72	15.18	14.18	13.30	11.82	10.64	8.50	7.09	6.08	5.32	4.73	4.25	3.87	3.60	3.27	3.04	2.84	2.66	2.50	2.37	2.24	2.13	1.94	1.78
86.00	21.50	17.92	15.36	14.34	13.44	11.94	10.76	8.60	7.17	6.14	5.38	4.78	4.30	3.91	3.64	3.31	3.08	2.87	2.69	2.53	2.39	2.27	2.15	1.96	1.80
87.00	21.75	18.13	15.54	14.50	13.59	12.08	10.88	8.70	7.25	6.22	5.44	4.84	4.35	3.96	3.69	3.35	3.11	2.90	2.72	2.56	2.42	2.30	2.18	1.98	1.82
88.00	22.00	18.32	15.72	14.68	13.76	12.22	11.00	8.80	7.34	6.29	5.50	4.89	4.40	4.00	3.73	3.39	3.15	2.94	2.75	2.59	2.45	2.32	2.20	2.00	1.84
89.00	22.25	18.54	15.89	14.83	13.91	12.36	11.13	8.90	7.42	6.36	5.57	4.95	4.45	4.05	3.78	3.43	3.18	2.97	2.79	2.62	2.48	2.35	2.23	2.03	1.86
90.00	22.50	18.76	16.08	15.00	14.06	12.50	11.26	9.00	7.50	6.43	5.63	5.00	4.50	4.10	3.82	3.47	3.22	3.00	2.82	2.65	2.50	2.37	2.25	2.05	1.88

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 40c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31⅓	32	32⅔	33	34	35	36
30	24	27	30	32	32	33	34	35	36	38	38	39	40	40	41	43	44
31	25	28	31	33	33	34	35	36	38	39	39	41	41	41	43	44	45
31½	26	28	31	33	33	34	36	37	38	40	40	41	42	42	44	45	46
32	26	29	31	34	34	35	36	38	39	41	41	42	42	43	44	45	47
32½	26	29	32	34	35	36	37	38	40	41	42	42	43	44	45	46	47
33	27	30	32	35	36	36	38	39	40	41	42	43	44	44	45	47	48
33½	27	30	33	35	36	37	38	39	41	42	43	44	45	45	46	48	49
34	28	30	33	36	37	37	39	40	41	43	43	44	46	45	47	48	50
35	28	31	35	37	38	38	40	41	43	44	45	45	46	47	48	50	51
36	29	32	35	39	39	40	41	42	45	45	46	47	47	48	50	51	52
37	30	33	36	39	39	41	42	43	45	46	47	48	49	49	51	53	54
38	31	34	37	40	41	42	43	45	46	48	49	49	50	51	52	54	55
39	32	35	38	41	42	42	44	47	47	48	50	50	51	52	54	55	57
40	32	36	39	43	43	44	45	47	49	50	51	51	53	53	55	57	58
41	33	37	40	43	44	45	47	48	50	51	52	53	54	55	56	58	60
41½	34	37	41	44	44	45	47	49	51	52	52	54	55	56	57	59	61
42	34	38	41	44	45	46	48	49	51	53	54	54	55	56	58	60	61
42½	34	38	41	45	46	47	48	50	52	54	54	55	56	57	59	61	62
43	35	38	42	45	46	47	49	51	52	54	55	56	57	58	59	61	63
44	36	39	43	46	47	48	50	52	54	56	56	57	58	59	61	62	64
44½	36	40	43	47	48	49	50	52	54	56	57	57	59	59	62	63	65
45	37	40	44	47	48	49	51	53	55	56	57	58	60	60	62	64	66
46	37	41	45	48	50	50	52	54	56	57	59	60	61	61	64	65	67
47	38	42	46	50	50	51	53	55	57	59	60	62	62	63	65	67	69
48	39	43	47	51	52	53	55	56	58	61	61	62	63	64	66	68	70
49	40	44	48	52	53	54	56	58	60	62	62	64	65	66	68	70	72
50	41	45	49	53	54	55	57	59	61	63	64	65	66	67	69	71	73

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 45c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32⅔	33	34	35	36
30	27	30	33	36	36	37	38	40	41	42	43	44	44	45	46	48	49
31	28	31	34	37	37	38	39	41	42	44	44	45	46	47	48	49	51
31½	29	31	34	37	38	39	40	42	43	45	45	46	47	47	49	50	52
32	29	32	35	38	39	39	41	42	44	45	46	47	47	48	50	51	52
32½	30	32	35	38	39	40	41	43	44	46	47	47	48	49	50	52	53
33	30	33	36	39	40	41	42	43	45	47	47	48	49	50	51	53	54
33½	30	33	37	40	40	41	43	44	46	47	48	49	50	50	52	53	55
34	31	34	37	40	41	42	43	45	46	48	49	50	50	51	53	54	56
35	32	35	38	41	42	43	45	46	48	49	50	51	52	53	54	56	57
36	33	36	39	43	43	44	46	48	49	51	52	53	53	54	56	57	59
37	34	37	40	44	44	46	47	49	51	52	53	54	55	56	57	59	61
38	35	38	41	45	46	47	48	50	52	54	55	55	56	57	59	61	62
39	36	39	43	46	47	48	50	52	53	55	56	57	58	59	60	62	64
40	36	40	44	47	48	49	51	53	55	57	58	58	59	60	62	64	66
41	37	41	45	49	49	50	52	54	56	58	59	60	61	62	64	65	67
41½	38	42	45	49	49	51	53	55	57	59	60	61	62	62	64	66	68
42	38	42	46	50	50	52	54	56	57	59	60	61	62	62	65	67	69
42½	39	43	46	50	51	52	54	56	58	60	60	62	63	64	66	68	70
43	39	43	47	51	52	53	55	57	59	61	62	63	64	65	67	69	71
44	40	44	48	52	53	54	56	58	60	62	63	65	65	66	68	70	72
44½	40	45	49	53	53	55	57	59	61	63	63	65	66	67	69	71	73
45	41	45	49	53	54	55	57	60	62	64	65	66	67	68	70	72	74
46	42	46	50	54	56	57	59	61	63	65	66	67	68	69	71	73	75
47	43	47	51	56	57	58	60	62	64	66	68	69	70	71	73	75	77
48	44	48	52	57	58	59	61	64	66	68	69	71	71	72	74	77	79
49	45	49	53	58	59	60	61	65	67	69	70	72	73	74	76	78	80
50	46	50	55	59	60	61	64	66	68	71	72	73	74	75	78	80	82

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 50c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32	33	34	35	36
30	30	33	36	39	40	41	42	44	46	47	48	49	49	50	52	53	55
31	31	34	38	41	41	42	44	45	47	49	49	50	51	52	53	55	56
31½	32	35	38	41	42	43	45	46	48	49	50	51	52	53	54	56	58
32	32	36	39	42	43	44	45	47	49	50	51	52	53	54	55	57	58
32½	33	36	39	43	43	44	46	48	49	51	52	53	54	54	56	58	59
33	33	37	40	43	44	45	47	48	50	52	53	54	54	54	57	59	60
33½	34	37	41	43	45	46	47	49	51	53	54	54	55	56	58	59	61
34	34	38	41	45	46	46	48	50	52	53	55	55	56	57	59	60	62
35	35	39	43	46	47	48	50	51	53	55	56	57	58	58	60	62	64
36	36	40	44	47	48	49	51	53	55	57	57	58	59	60	62	64	66
37	37	41	45	49	50	51	52	54	56	58	59	60	61	62	64	66	68
38	38	42	46	50	51	52	54	56	58	60	61	62	63	64	66	67	69
39	39	43	47	51	52	53	55	57	59	61	62	63	64	65	67	69	71
40	40	44	49	53	54	55	57	59	61	63	63	65	66	67	69	71	73
41	41	46	50	54	55	56	58	60	62	64	65	66	68	69	71	73	75
41½	42	46	50	55	56	57	59	61	63	65	66	67	68	70	72	74	76
42	42	47	51	55	56	57	60	62	64	66	67	68	69	70	72	75	77
42½	53	47	52	56	57	58	60	62	65	67	68	69	70	71	73	76	78
43	44	48	52	57	58	59	61	63	65	67	69	70	71	72	74	76	79
44	45	49	53	58	59	60	62	65	67	69	70	71	72	74	76	78	80
44½	45	49	54	59	60	61	63	65	68	70	71	72	73	76	77	79	81
45	46	50	55	59	60	61	64	66	69	71	72	73	74	76	77	80	82
46	47	51	56	61	62	63	65	68	70	72	74	75	76	77	79	82	84
47	48	52	57	62	63	64	67	69	72	74	75	76	78	79	81	84	86
48	39	53	58	63	64	66	68	70	73	76	77	78	79	81	83	85	88
49	50	54	59	64	66	67	70	72	75	77	78	80	81	82	85	87	90
50	51	55	61	66	67	68	71	74	76	79	80	81	83	84	86	89	91

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 60c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	36	40	44	47	48	49	51	53	55	56	58	58	59	60	62	64	66
31	38	41	45	49	50	51	53	55	56	58	60	60	61	62	64	66	68
31½	38	42	46	50	50	52	54	55	57	59	60	61	62	63	65	67	69
32	39	43	47	51	51	52	54	56	58	60	61	62	63	64	66	68	70
32½	39	43	47	51	52	53	55	57	59	61	62	63	64	65	67	69	71
33	40	44	48	52	53	54	56	58	60	62	64	64	65	66	68	70	72
33½	41	45	49	53	53	55	57	59	61	63	64	65	66	67	69	71	73
34	41	45	50	54	55	56	58	60	62	64	66	66	67	68	70	72	74
35	43	47	51	55	56	57	60	62	64	66	68	68	69	70	72	74	77
36	44	48	52	57	58	59	61	63	66	68	70	70	71	72	74	77	79
37	45	49	54	58	60	60	63	65	67	70	72	72	73	74	76	79	80
38	46	50	55	60	61	62	65	67	69	72	74	74	75	76	78	80	83
39	47	52	57	62	63	64	66	69	71	73	75	76	77	78	81	83	85
40	49	53	58	63	64	66	68	71	73	75	78	78	79	80	83	85	87
41	50	55	60	65	66	67	70	72	75	77	80	80	81	82	85	87	90
41½	50	55	60	66	67	68	70	73	75	78	81	81	82	83	86	88	91
42	51	56	61	66	68	69	71	74	77	79	82	82	83	84	87	88	92
42½	52	57	62	67	68	70	72	75	77	80	83	83	84	85	88	90	93
43	52	57	63	68	69	71	73	76	78	81	84	84	85	86	89	91	94
44	53	59	64	69	71	72	75	78	80	83	86	86	87	88	91	94	96
44½	54	59	66	70	72	73	76	78	81	84	86	86	88	89	92	95	97
45	55	60	66	71	72	74	77	79	82	85	88	88	89	90	93	96	98
46	56	61	67	73	74	75	78	81	84	87	90	90	90	92	95	98	101
47	57	63	69	74	76	77	80	83	86	89	92	92	93	94	97	100	103
48	58	64	70	76	77	79	82	85	87	91	94	94	95	96	99	102	105
49	60	65	71	77	79	80	83	86	89	92	94	95	97	98	101	104	107
50	60	67	73	79	80	82	85	88	91	94	96	97	99	100	103	106	109

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 65c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	39	43	47	51	52	53	55	57	59	61	62	63	64	65	67	69	71
31	41	45	49	53	54	55	57	59	61	63	64	65	66	67	69	71	73
31½	41	46	50	54	55	56	58	60	62	64	65	66	68	68	71	73	75
32	42	46	51	55	56	57	59	61	63	65	66	67	69	70	72	74	76
32½	43	47	51	56	57	58	60	62	64	66	67	69	70	71	73	75	77
33	43	48	52	56	58	59	61	63	65	67	68	70	71	72	74	76	78
33½	44	48	53	57	58	59	62	64	66	68	70	71	72	73	75	77	79
34	45	49	54	58	59	60	63	65	67	69	71	72	73	74	76	78	80
35	46	51	55	60	61	62	64	67	69	71	73	74	75	76	78	81	83
36	47	52	57	62	63	64	66	69	71	73	75	76	77	78	81	83	85
37	49	54	58	63	65	66	68	71	73	75	77	78	79	80	83	85	88
38	50	55	60	65	66	67	70	72	75	78	79	80	81	83	85	88	90
39	51	56	62	67	68	69	72	74	77	80	81	82	84	85	87	90	92
40	53	58	63	68	70	71	74	76	79	82	83	84	86	87	90	92	95
41	54	59	65	70	71	73	75	78	81	84	85	87	88	89	92	95	97
41½	55	60	65	71	72	74	76	79	82	85	86	88	89	90	93	96	98
42	55	61	66	72	73	75	77	80	83	86	87	89	90	91	94	97	99
42½	56	61	67	73	74	75	78	81	84	87	88	90	91	92	95	98	101
43	57	62	68	74	75	76	79	82	85	88	89	91	92	94	96	99	102
44	58	64	69	75	77	78	81	84	87	90	91	93	95	96	99	101	104
44½	59	64	70	76	78	79	82	85	88	91	92	94	96	97	100	103	105
45	59	65	71	77	79	80	83	86	89	92	93	95	97	98	101	104	107
46	61	66	73	79	80	82	85	88	91	94	95	97	99	100	103	106	109
47	62	68	74	80	82	83	87	90	93	96	98	99	101	102	105	108	111
48	63	70	76	82	84	85	88	92	95	98	100	101	103	105	108	111	114
49	64	71	77	84	85	87	90	94	97	100	102	103	105	107	110	113	116
50	66	72	79	85	87	89	92	95	99	102	104	105	107	109	112	115	118

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 70c per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	42	47	51	55	56	57	59	62	64	66	67	68	69	70	72	74	77
31	44	48	53	57	58	59	61	64	66	68	69	70	72	73	75	77	79
31½	45	49	54	58	59	60	62	65	67	69	70	71	73	74	76	78	80
32	45	50	54	59	60	61	63	66	68	70	72	73	74	75	77	80	82
32½	46	51	55	60	61	62	64	67	69	71	73	74	75	76	78	81	83
33	47	51	56	61	62	63	65	68	70	73	74	75	76	77	80	82	84
33½	47	52	57	62	63	64	66	69	71	74	75	76	77	79	81	83	85
34	48	53	58	63	64	65	67	70	72	75	76	77	78	80	82	84	87
35	50	54	59	64	66	67	69	72	74	77	78	80	81	82	84	87	89
36	51	56	61	66	68	69	71	74	77	79	80	82	83	84	87	89	92
37	52	58	63	68	70	71	73	76	79	81	83	84	85	86	89	92	95
38	54	59	65	70	71	73	75	78	81	84	85	86	88	89	92	94	97
39	55	61	66	72	73	75	77	80	83	86	87	89	90	91	94	97	99
40	57	62	68	74	75	76	79	82	85	88	90	91	92	93	96	99	102
41	58	64	70	75	77	78	81	84	87	90	92	93	95	96	99	102	105
41½	59	65	71	76	78	79	82	85	88	91	93	94	96	97	100	103	106
42	60	65	71	77	79	80	83	86	89	92	94	95	97	98	101	104	107
42½	60	66	72	78	80	81	84	87	90	93	95	97	98	100	103	105	108
43	61	67	73	79	81	82	85	88	92	95	96	98	99	101	104	106	109
44	62	69	75	81	83	84	87	90	94	97	98	100	102	103	106	109	112
44½	63	69	76	82	84	85	88	91	95	98	99	101	103	104	107	110	114
45	64	70	77	83	85	86	89	92	96	99	101	102	104	106	109	112	115
46	65	72	78	85	86	88	91	95	98	101	103	105	106	108	111	114	117
47	67	73	80	87	88	90	93	97	100	103	105	107	109	110	113	117	119
48	68	75	82	88	90	92	95	99	102	106	107	109	111	113	116	119	123
49	70	76	83	90	92	94	97	101	104	108	109	111	113	115	118	122	125
50	71	78	85	92	94	96	99	103	106	110	112	114	115	117	121	124	128

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, 75c per 100 Sheets, 26" x 38"

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	45	50	55	59	60	61	64	66	68	71	72	73	74	75	77	80	82
31	47	52	56	61	62	63	66	68	71	73	74	75	77	78	80	82	85
31½	48	53	57	62	63	65	67	69	72	74	75	77	78	79	81	84	86
32	49	53	58	63	64	66	68	70	73	75	77	78	79	80	83	85	87
32½	49	54	59	64	65	67	69	71	74	77	78	79	80	82	84	86	89
33	50	55	60	65	66	68	70	72	75	78	79	80	82	83	85	88	90
33½	51	56	61	66	67	69	71	74	76	79	80	82	83	84	87	89	92
34	52	57	62	67	68	70	72	75	77	80	81	83	84	85	88	90	93
35	53	58	64	69	70	72	74	77	80	82	84	85	86	88	90	93	95
36	55	60	66	71	72	74	76	79	82	85	86	88	89	90	93	96	98
37	56	62	67	73	74	76	79	81	84	87	89	90	92	93	96	98	101
38	58	63	69	75	75	78	81	83	86	89	91	92	94	95	98	101	104
39	59	65	71	77	78	80	83	85	89	92	93	95	96	98	101	103	106
40	61	67	73	79	80	82	85	87	91	94	96	97	99	100	103	106	109
41	62	67	75	81	82	84	87	90	93	96	98	100	101	103	106	109	112
41½	63	69	76	82	83	85	88	91	95	98	99	101	103	104	107	110	113
42	64	70	77	83	84	86	89	92	96	99	100	102	104	105	109	112	115
42½	65	71	77	84	85	87	90	93	97	100	100	103	105	107	110	113	116
43	65	72	78	85	86	88	91	95	98	101	103	104	106	108	111	114	118
44	67	74	80	87	89	90	94	97	100	104	105	107	109	110	114	117	120
44½	68	74	81	88	90	91	95	98	101	105	106	108	110	112	115	118	122
45	68	75	82	89	91	92	96	99	102	106	108	109	111	113	116	119	123
46	70	77	84	91	93	94	98	101	105	108	110	112	114	115	119	122	126
47	71	78	85	93	95	96	100	103	107	111	112	114	116	118	121	125	128
48	73	80	87	94	97	98	102	105	109	113	115	117	118	120	124	128	131
49	74	82	89	97	99	101	104	108	112	115	117	119	121	123	126	130	134
50	76	83	91	99	101	103	106	109	114	118	120	122	124	125	128	133	136

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, $1.25 per 100 Sheets, 26" x 38"

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	76	84	91	99	101	103	106	110	114	118	119	122	124	126	129	133	137
31	78	86	94	102	104	106	109	114	118	122	124	126	128	129	133	137	141
31½	80	88	96	104	106	108	111	116	119	124	126	128	129	132	136	139	143
32	81	89	97	105	107	109	113	118	121	126	128	129	132	134	138	142	146
32½	82	90	99	107	109	111	115	119	123	128	129	132	134	136	139	144	148
33	83	92	100	109	111	113	117	121	125	129	132	134	136	138	142	146	150
33½	85	93	102	110	112	115	119	123	127	132	134	136	138	140	144	148	153
34	86	95	103	112	114	116	120	125	129	134	136	138	139	142	146	151	155
35	89	97	106	115	117	119	124	128	133	137	139	142	144	146	151	155	159
36	91	100	109	118	121	123	128	132	136	141	144	146	148	150	155	159	164
37	94	103	112	122	124	126	131	136	140	145	147	149	153	155	159	164	169
38	96	106	115	125	127	129	134	139	144	149	152	154	157	159	164	168	173
39	99	109	118	128	131	133	138	143	148	153	156	158	161	163	168	173	178
40	101	111	122	132	134	136	142	147	152	157	159	162	165	167	172	177	182
41	104	114	124	135	147	140	145	150	156	161	163	166	169	172	177	182	187
41½	105	116	126	137	139	142	147	152	158	163	165	169	171	173	179	184	189
42	106	117	128	138	141	143	149	154	159	165	167	170	172	175	181	186	192
42½	108	118	129	140	142	145	150	156	161	167	169	172	175	178	183	188	194
43	109	119	131	142	144	147	152	158	163	169	172	175	178	179	185	191	196
44	111	122	134	145	148	150	156	162	167	173	176	178	181	184	189	195	201
44½	113	124	135	146	149	152	158	163	169	175	178	181	183	186	192	198	203
45	114	125	137	148	151	154	159	165	171	177	179	183	186	188	194	199	205
46	117	128	139	152	154	157	163	169	175	181	184	186	189	193	198	204	209
47	119	131	143	155	158	161	166	172	179	185	188	191	194	197	203	209	214
48	122	134	146	158	161	164	170	176	182	189	192	194	198	201	207	213	219
49	124	136	149	161	164	168	174	180	186	193	196	199	202	205	211	217	224
50	127	139	152	165	168	171	177	184	189	197	199	203	206	209	216	222	228

Arranged by H. L. Stortz, Philadelphia

Cost of Sheet Lining, 1/s Basis, $1.75 per 100 Sheets, 26″ x 38″

COST SHOWN IN CENTS

Size	20	22	24	26	26½	27	28	29	30	31	31½	32	32½	33	34	35	36
30	106	117	127	138	141	143	148	154	159	165	168	170	173	175	180	186	191
31	109	121	132	143	145	148	153	159	164	169	173	176	179	181	187	192	197
31½	111	123	134	145	148	150	156	162	167	173	176	179	182	184	189	195	201
32	113	125	136	147	150	153	158	164	169	176	179	182	184	187	193	198	204
32½	115	127	138	149	153	155	161	167	173	179	182	184	187	190	196	202	207
33	117	129	140	152	155	158	163	169	175	181	184	187	190	193	199	205	210
33½	119	130	142	154	157	160	166	172	178	184	187	189	193	196	202	208	213
34	120	132	144	156	159	162	168	175	180	187	189	193	196	199	205	211	216
35	124	136	148	161	164	167	173	179	186	192	195	198	202	205	211	217	223
36	127	139	153	166	169	172	178	185	191	198	201	204	207	210	217	223	229
37	131	144	157	170	174	177	183	189	197	203	206	209	213	216	223	229	236
38	134	148	162	175	178	182	188	195	202	209	212	216	219	222	229	235	242
39	138	152	166	179	183	187	193	200	207	214	218	221	225	228	235	242	249
40	142	156	169	184	188	192	198	205	213	219	223	227	231	234	241	248	255
41	145	159	174	189	193	196	203	210	218	225	229	232	236	239	247	254	261
41½	147	162	176	191	195	199	205	213	220	228	232	236	239	243	249	257	265
42	149	163	179	193	197	201	208	216	223	231	234	238	242	246	253	260	268
42½	150	165	180	196	199	203	211	218	226	234	237	242	245	249	256	263	271
43	152	167	183	199	202	206	213	220	229	236	240	244	248	252	259	267	274
44	156	171	187	203	206	210	218	226	234	242	246	249	253	257	265	273	280
44½	158	173	189	205	209	213	221	229	236	245	249	252	256	260	268	276	283
45	159	175	191	207	211	215	223	231	239	247	252	255	259	263	271	279	286
46	163	179	195	212	216	219	228	236	245	253	257	261	265	269	277	285	293
47	167	183	199	216	221	225	233	240	249	258	262	266	270	275	283	291	299
48	169	187	204	221	226	229	238	246	255	264	268	272	276	280	289	297	306
49	174	191	208	226	229	234	243	251	259	269	274	278	282	287	295	304	312
50	177	195	212	230	235	239	248	256	266	274	279	283	288	293	301	309	318

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Paper Tables

TABLE OF EQUIVALENT WEIGHTS. BASIS 25″x38″

20x24	20.1	25.2	30.4	35.3	40.4	46.5	50.5	60.7
20x25	21	26.3	31.6	36.8	42.1	47.4	52.6	63.2
20x26	21.9	27.4	32.8	38.3	43.8	49.3	54.7	65.7
20x28	23.6	29.5	35.4	41.3	47.2	53.1	58.9	70.7
20x30	25.3	31.6	37.9	44.2	50.5	56.8	63.2	75.8
20x31	26.1	32.6	39.2	45.7	52.2	58.7	65.3	78.3
22x24	22.2	27.8	33.5	39	44.5	50	55.7	66.8
22x28	25.9	32.4	38.8	45.3	51.8	58.3	64.7	77.7
24x30	30.3	37.9	45.5	53.1	60.6	68.2	75.8	90.9
24x36	36.4	45.5	54.6	63.7	72.8	81.9	91.1	109.3
25x38	40	50	60	70	80	90	100	120
26x38	41.6	52	62.3	72.7	83	93.5	104	125
30x40	50.5	63.2	75.8	88.4	101.1	113.7	126.3	151.6

Arranged by H. L. Stortz, Philadelphia

SCALE OF WEIGHTS EQUAL TO 24 x 36

24 x 36	15	20	25	30	35	40	50	60	70	80	90	100	125	150
12 x 18	4	5	6	8	9	10	13	15	18	20	23	25	31	38
15 x 20	5	7	9	11.	12	14	18	21	24	28	31	35	44	52
18 x 24	8	10	13	15	18	20	25	30	35	40	45	50	63	75
20 x 30	11	14	18	21	25	28	35	42	49	56	63	70	87	105
22 x 32	12	16	20	25	29	33	40	50	57	65	74	80	102	120
26 x 36	16	22	27	33	38	44	54	65	76	87	98	109	136	163
30 x 40	21	28	35	42	49	56	70	84	97	112	125	140	174	209
36 x 40	25	34	42	50	59	67	84	100	117	134	150	167	209	250
40 x 48	34	45	56	67	78	90	112	133	156	180	200	224	278	336
48 x 52	44	58	72	87	101	116	144	174	202	232	261	288	360	432
48 x 64	54	71	89	107	125	142	178	214	250	284	321	356	445	534

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For other sizes the estimator is referred to "Carnell's Ready Reckoning" for book, news and cover papers, published by Ambrose S. Carnell, 150 Nassau St., New York City.

Also for Paper and Board Equivalents, the estimator will find the Paper Equivalentor, marketed by Ralph Landenberger, 175 W. Jackson Blvd., Chicago, a very handy circular sliding rule which will give all equivalents on board and paper by an easy method. Partial description:

The Paper Equivalentor is, as its name suggests, an instrument for finding equivalents.

It will instantly and accurately find:

1. The equivalent weight per ream in any possible size sheet.
2. The equivalent price per 100 sheets of card-board in any possible size sheet.
3. The equivalent number of sheets to a bundle of box-board or straw-board in any possible size sheet.
4. The proportionate size of any cut or drawing for reduction or enlargement.

In three slight movements.

Even if your size should include fractions of an inch, such as 29¼ x 47½, its equivalent can be as readily found as any stock size.

Exact Equivalent of Stock Sizes: It is useful also in determining the exact equivalent in stock sizes, as compared to the

approximate equivalent usually found in tables of comparative weight, for instance: Taking as a basis 17 x 22—20, the equivalent weight in double double cap, 28 x 34, is usually considered as 48, while the actual equivalent, as shown by the Paper Equivalentor, is 28 x 34—51.

Cardboard Equivalents: The same method exactly is used for finding card-board equivalents. If 100 sheets of 22 x 28 cost $2.45, the cost in 42½ x 45 or any possible size is found in three slight movements.

For the Paper Box Manufacturer or anyone who handles box-board or straw-board, the problem of how many sheets to a bundle of 50 pounds in, for instance, 34½ x 43, or any other size, using as a basis the usual 26 x 38 or any other basis, is found with the Paper Equivalentor in three slight movements.

Multiplies and Divides: It multiplies with one operation, for instance, 49¼ x 3¾. Divides with equal facility. Better than an ordinary slide rule for this, because of more numbered divisions. Nothing left to calculate. Useful in finding the unit rate of costs.

For Proportions: For the Printer, Lithographer or Photo-Engraver who has a drawing, say 5 x 8 inches, and wishing to know what the height would be if width were reduced to 3¼ inches, or vice-versa, has only to pick up the Paper Equivalentor and find the answer in three slight movements.

And, what is perhaps the most noteworthy point of all, the range is from 1 to 100 inches.

Slide Rules and Tables

There are a number of Slide Tables offered to the Industry giving in convenient form the cost per 100 sheets of box-board cost of paper and equivalents. These can be used to advantage and among others we mention: Sliding table offered by Samuel Langston, Camden, N. J.; Hobbs Mfg. Co., Worcester, Mass.; American Writing Paper Co., Holyoke, Mass.

The Slide Rule

The instrument which is used for calculations by the Engineering Profession and which can be purchased from any dealer in engineering supplies will be found to be an invaluable assistance to the estimator, the use, however, of this rule with facility must be acquired by study. It is mentioned here so that attention may be called to all methods or instruments to assist the estimator in his work.

Quick Rule for Ascertaining Number of Sheets to 1000 Boxes, Cut from Paper Size of Sheets as Given

This rule assumes that paper is all used and no offals are considered, the basis being the same as if figured by square inches.

This ingenious rule arranged by Walter Trumm, Brooklyn, N. Y., can be obtained in convenient ruler form for desk use of Walther & Co., 72 Duane St., New York City.

	26x20	25x20	24x20
1″	1.92	2.00	2.08
1¼	2.40	2.50	2.60
1½	2.88	3.00	3.12
1¾	3.36	3.50	3.64
2	3.84	4.00	4.16
2¼	4.32	4.50	4.68
2½	4.80	5.00	5.20
2¾	5.28	5.50	5.72
3	5.76	6.00	6.24
3¼	6.24	6.50	6.76
3½	6.72	7.00	7.28
3¾	7.20	7.50	7.80
4	7.68	8.00	8.32
4¼	8.16	8.50	8.84
4½	8.64	9.00	9.36
4¾	9.12	9.50	9.88
5	9.60	10.00	10.40
5¼	10.08	10.50	10.92
5½	10.56	11.00	11.44
5¾	11.44	11.50	11.96
6	11.52	12.00	12.48
6¼	12.00	12.50	13.00
6½	12.48	13.00	13.52
6¾	12.96	13.50	14.04
7	13.44	14.00	14.56
7¼	13.92	14.50	15.08
7½	14.40	15.00	15.60
7¾	14.88	15.50	16.12
8	15.36	16.00	16.64
8¼	15 84	16.50	17.16
8½	16.22	17.00	17.68
8¾	16.80	17.50	18.20
9	17.28	18.00	18.72
9¼	17.76	18.50	19.24
9½	18.24	19.00	19.76
9¾	18.72	19.50	20.28
10	19.20	20.00	20.80

One dimension of box multiplied by figure on table opposite other dimension 24x20 will give number of sheets either 25x20 26x20 required per M boxes.

Example:

Box 10 x 6—3 in. high. Cover 1 in.
10 x 6 (2 sides) = 32″ around
+ 2″ lap = 34″.
3 + 1 = 4″ high + 2″ turn in
= 6″.
34″ × 6″
number opposite 6″ on table is 12.48 for sheets 24 x 20 × other dimensions 34

424 sheets 424

Top label 10 x 6
Number opposite 6″ 12.48
× other dimension 10.

125 sheets 125

549 sheets 24 x 20 per 1000 boxes

For wrap work use same method as for top label.

Strip Paper Table

MAXIMUM NUMBER OF RUNNING INCHES THAT CAN BE CUT FROM SHEET—WIDTH ½″ TO 6″, ALSO SHOWING WIDTH OF OFFAL ON LEFTOVER STRIP

	20x24 Width of Roll 20″		20x24 Width of Roll 24″		20x25 Width of Roll 25″		20x26 Width of Roll 26″		20x28 Width of Roll 28″		20x30 Width of Roll 30″		20x31 Width of Roll 31″	
½	960	0	960	0	1000	0	1040	0	1120	0	1200	0	1240	0
⅝	768	0	768	0	800	0	820	⅜	880	½	960	0	980	⅜
¾	624	0	640	0	660	¼	680	½	740	¼	800	0	820	¼
⅞	528	¾	540	⅜	560	½	580	⅝	640	0	680	¼	700	⅜
1	480	0	480	0	500	0	520	0	560	0	600	0	620	0
1⅛	408	⅞	420	⅜	440	¼	460	⅛	480	1	520	¾	540	⅝
1¼	384	0	380	¼	400	0	400	1	440	½	480	0	480	1
1⅜	336	¾	340	⅝	360	¼	360	1¼	400	½	420	⅛	480	1⅛
1½	312	½	320	0	320	1	340	½	360	1	400	0	400	1
1⅝	288	½	280	1¼	300	⅜	320	0	340	⅜	360	¾	380	⅛
1¾	264	¾	260	1¼	280	½	280	1½	320	0	340	¼	340	1¼
1⅞	240	1¼	240	1½	260	⅝	260	1⅝	280	1¾	320	0	320	1
2	240	0	240	0	240	0	260	0	280	0	300	0	300	1
2⅛	216	⅞	220	⅝	220	1⅝	240	½	260	⅜	280	¼	280	1¼
2¼	192	2	200	1½	220	¼	220	1¼	240	1	260	¾	260	1¾
2⅜	192	1	200	1¼	200	1¼	200	2¼	220	⅞	240	1½	260	⅛
2½	192	0	180	1⅛	200	0	200	1	220	½	240	0	240	1
2⅝	168	1⅝	180	⅜	180	1⅜	180	1⅜	200	1¾	220	1⅛	220	2⅛
2¾	168	¾	160	2	180	¼	180	1¼	200	½	200	1½	220	¾
2⅞	144	1½	160	1	160	2	180	⅛	180	2⅛	200	1¼	200	2¼
3	144	0	160	0	160	1	160	2	180	1	200	0	200	1
3⅛	144	2⅛	140	2⅛	160	0	160	1	160	3	180	1⅞	180	2⅞
3¼	144	1¼	140	1¼	140	1⅝	160	0	160	2	180	¾	180	1¾
3⅜	120	⅜	140	⅜	140	1⅛	140	2⅜	160	1	160	3	180	⅝
3½	120	2½	120	3	140	½	140	1½	160	0	160	2	160	3
3⅝	120	3¼	120	2¼	120	3¼	140	⅝	140	2⅝	160	1	160	2
3¾	120	1½	120	1½	120	2½	120	3½	140	1¾	160	0	160	1
3⅞	120	¾	120	¾	120	1¾	120	2¾	140	⅞	140	2⅞	160	0
4	120	0	120	0	120	1	120	2	140	0	140	2	140	3
4⅛	96	3⅜	100	3⅜	120	¼	120	1¼	120	3¼	140	1⅛	140	2⅛
4¼	96	3	100	2⅜	100	3¾	120	½	120	2½	140	¼	140	1¼
4⅜	96	2½	100	2⅛	100	3⅛	100	4⅛	120	1¾	120	3¾	140	⅜
4½	96	2	100	1½	100	2½	100	3½	120	1	120	3	120	4
4⅝	96	1½	100	⅞	100	1⅞	100	2⅞	120	¼	120	2¼	120	3¼
4¾	96	1	100	¼	100	1¼	100	2¼	100	4¼	120	1½	120	2½
4⅞	96	½	80	4½	100	⅝	100	1⅝	100	3⅝	120	¾	120	1¾
5	96	0	80	4	100	0	100	1	100	3	120	0	120	1
5⅛	72	4⅝	80	3½	80	4½	100	⅜	100	2⅜	100	4⅜	120	¼
5¼	72	4¼	80	3	80	4	80	5	100	1¾	100	3¾	100	4¾
5⅜	72	3⅞	80	2½	80	3½	80	4½	100	1⅛	100	3⅛	100	4⅛
5½	72	3½	80	2	80	3	80	4	100	½	100	2½	100	3½
5⅝	72	3⅛	80	1½	80	2½	80	3½	80	5½	100	1⅞	100	2⅞
5¾	72	2¾	80	1	80	2	80	3	80	5	100	1¼	100	2¼
5⅞	72	2⅜	80	½	80	1½	80	2½	80	4½	100	⅝	100	1⅝
6	72	2	80	0	80	1	80	2	80	4	100	0	100	1

Arranged by H. L. Stortz, Philadelphia

Paper Table, 500 Sheets to Ream

SHOWING COST PER 100 SHEETS 20″x24″ TO 30″x40″

Price per R. 20x24		20x24	20x26	24x30	26x30	24x36	25x38	26x38	30x40
$1.00	Per Ream . .	$1.00	$1.08	$1.50	$1.63	$1.80	$1.98	$2.06	$2.50
	100 Sheets . .	.20	.22	.30	.33	.36	.40	.41	.50
1.25	Ream	1.25	1.35	1.88	2.03	2.25	2.47	2.57	3.13
	100 Sheets . .	.25	.27	.38	.41	.45	.49	.51	.63
1.50	Ream	1.50	1.62	2.25	2.44	2.70	2.97	3.09	3.75
	100 Sheets . .	.30	.32	.45	.49	.54	.59	.62	.75
1.75	Ream	1.75	1.90	2.63	2.84	3.15	3.46	3.60	4.38
	100 Sheets . .	.35	.38	.53	.57	.63	.69	.72	.88
2.00	Ream	2.00	2.17	3.00	3.25	3.60	3.96	4.12	5.00
	100 Sheets . .	.40	.43	.60	.65	.72	.79	.82	1.00
2.25	Ream	2.25	2.44	3.38	3.66	4.05	4.46	4.64	5.63
	100 Sheets . .	.45	.49	.68	.73	.81	.89	.93	1.13
2.50	Ream	2.50	2.71	3.75	4.06	4.50	4.96	5.15	6.25
	100 Sheets . .	.50	.54	.75	.81	.90	.99	1.03	1.25
2.75	Ream	2.75	2.98	4.13	4.47	4.95	5.46	5.67	6.88
	100 Sheets . .	.55	.60	.83	.89	.99	1.09	1.13	1.38
3.00	Ream	3.00	3.25	4.50	4.88	5.40	5.94	6.17	7.50
	100 Sheets . .	.60	.65	.90	.98	1.08	1.19	1.23	1.50
3.25	Ream	3.25	3.52	4.88	5.29	5.85	6.44	6.69	8.13
	100 Sheets . .	.65	.70	.98	1.06	1.17	1.29	1.34	1.63
3.50	Ream	3.50	3.79	5.25	5.70	6.30	6.94	7.21	8.76
	100 Sheets . .	.70	.76	1.05	1.14	1.26	1.39	1.45	1.75
3.75	Ream	3.75	4.06	5.63	6.10	6.75	7.44	7.73	9.39
	100 Sheets . .	.75	.81	1.13	1.22	1.35	1.49	1.55	1.88
4.00	Ream	4.00	4.33	6.00	6.50	7.20	7.92	8.23	10.00
	100 Sheets . .	.80	.87	1.20	1.30	1.44	1.58	1.65	2.00
4.25	Ream	4.25	4.60	6.38	6.91	7.65	8.42	8.75	10.63
	100 Sheets . .	.85	.92	1.28	1.38	1.53	1.68	1.75	2.13
4.50	Ream	4.50	4.87	6.76	7.31	8.10	8.92	9.27	11.26
	100 Sheets . .	.90	.97	1.35	1.46	1.62	1.78	1.85	2.25
4.75	Ream	4.75	5.14	7.14	7.72	8.55	9.42	9.79	11.89
	100 Sheets . .	.95	1.03	1.43	1.54	1.71	1.88	1.96	2.38
5.00	Ream	5.00	5.42	7.50	8.13	9.00	9.90	10.29	12.50
	100 Sheets . .	1.00	1.08	1.50	1.63	1.80	1.98	2.06	2.50

Paper Table, 500 Sheets to Ream

SHOWING COST PER 100 SHEETS 20″x24″ TO 30″x40″—(Continued)

Price per R. 20x24		20x24	20x26	24x30	26x30	24x36	25x38	26x38	30x40
$5.50	Ream	$5.50	$5.96	$8.25	$8.94	$9.90	$10.89	$11.32	$13.75
	100 Sheets . .	1.10	1.19	1.65	1.79	1.98	2.18	2.26	2.75
6.00	Ream	6.00	6.50	9.00	9.75	10.80	11.87	12.35	15.00
	100 Sheets . .	1.20	1.30	1.80	1.95	2.16	2.37	2.47	3.00
6.50	Ream	6.50	7.04	9.75	10.56	11.70	12.86	13.38	16.25
	100 Sheets . .	1.30	1.41	1.95	2.11	2.34	2.57	2.67	3.25
7.00	Ream	7.00	7.58	10.50	11.38	12.60	13.85	14.41	17.50
	100 Sheets . .	1.40	1.52	2.10	2.28	2.52	2.77	2.88	3.50
7.50	Ream	7.50	8.12	11.25	12.19	13.50	14.84	15.44	18.75
	100 Sheets . .	1.50	1.22	2.25	2.54	2.70	2.97	3.09	3.75
8.00	Ream	8.00	8.66	12.00	13.00	14.40	15.83	16.46	20.00
	100 Sheets . .	1.60	1.73	2.40	2.60	2.88	3.17	3.29	4.00
8.50	Ream	8.50	9.20	12.75	13.81	15.30	16.82	17.49	21.25
	100 Sheets . .	1.70	1.84	2.55	2.76	3.06	3.36	3.49	4.25
9.00	Ream	9.00	9.75	13.50	14.63	16.20	17.81	18.52	22.50
	100 Sheets . .	1.80	1.95	2.70	2.93	3.24	3.56	3.70	4.50
9.50	Ream	9.50	10.29	14.25	15.44	17.10	18.80	19.55	23.75
	100 Sheets . .	1.90	2.06	2.85	3.09	3.42	3.76	3.91	4.75
10.00	Ream	10.00	10.83	15.00	16.25	18.00	19.79	20.58	25.00
	100 Sheets . .	2.00	2.17	3.00	3.25	3.60	3.96	4.12	5.00
10.50	Ream	10.50	11.37	15.75	17.06	18.90	20.78	21.61	26.25
	100 Sheets . .	2.10	2.27	3.15	3.41	3.78	4.16	4.32	5.25
11.00	Ream	11.00	11.91	16.50	17.88	19.80	21.77	22.64	27.50
	100 Sheets . .	2.20	2.38	3.30	3.58	3.96	4.35	4.53	5.50
11.50	Ream	11.50	12.45	17.25	18.69	20.70	22.76	23.67	28.75
	100 Sheets . .	2.30	2.49	3.45	3.74	4.14	4.55	4.73	5.75
12.00	Ream	12.00	13.00	18.00	19.50	21.60	23.75	24.70	30.00
	100 Sheets . .	2.40	2.60	3.60	3.90	4.32	4.75	4.94	6.00
12.50	Ream	12.50	13.54	18.75	20.31	22.50	24.74	25.73	31.25
	100 Sheets . .	2.50	2.71	3.75	4.06	4.50	4.95	5.15	6.25
13.00	Ream	13.00	14.08	19.50	21.13	23.40	25.73	26.75	32.50
	100 Sheets . .	2.60	2.82	3.90	4.23	4.68	5.15	5.35	6.50
13.50	Ream	13.50	14.62	20.25	21.94	24.30	26.72	27.78	33.75
	100 Sheets . .	2.70	2.92	4.05	4.39	4.68	5.34	5.56	6.75

Paper Table, 500 Sheets to Ream

SHOWING COST PER 100 SHEETS 20″x24″ TO 30″x40″—(Continued)

$14.00	Ream	$14.00	$15.16	$21.00	$22.75	$25.20	$27.71	$28.81	$35.00
	100 Sheets . .	2.80	3.03	4.20	4.55	5.04	5.54	5.76	7.00
14.50	Ream	14.50	15.70	21.75	23.56	26.10	28.70	29.84	36.25
	100 Sheets . .	2.90	3.14	4.35	4.71	5.22	5.74	5.97	7.25
15.00	Ream	15.00	16.25	22.50	24.38	27.00	29.69	30.87	37.50
	100 Sheets . .	3.00	3.25	4.50	4.88	5.40	5.94	6.17	7.50
15.50	Ream	15.50	16.79	23.25	25.19	27.90	30.68	31.90	38.75
	100 Sheets . .	3.10	3.36	4.65	5.04	5.58	6.14	6.38	7.75
16.00	Ream	16.00	17.33	24.00	26.00	28.80	31.67	32.93	40.00
	100 Sheets . .	3.20	3.46	4.80	5.20	5.76	6.33	6.58	8.00
16.50	Ream	16.50	17.87	24.75	26.81	29.70	32.66	33.96	41.25
	100 Sheets . .	3.30	3.57	4.95	5.36	5.94	6.53	6.79	8.25
17.00	Ream	17.00	18.41	25.50	27.63	30.60	33.64	34.99	42.50
	100 Sheets . .	3.40	3.68	5.10	5.53	6.12	6.73	6.99	8.50
17.50	Ream	17.50	18.95	26.25	28.44	31.50	34.63	36.02	43.75
	100 Sheets . .	3.50	3.79	5.25	5.69	6.30	6.92	7.20	8.75
18.00	Ream	18.00	19.49	27.00	29.25	32.40	35.62	37.04	45.00
	100 Sheets . .	3.60	3.89	5.40	5.85	6.48	7.12	7.41	9.00
18.50	Ream	18.50	20.03	27.75	30.06	33.30	36.61	38.06	46.25
	100 Sheets . .	3.70	4.01	5.55	6.01	6.66	7.32	7.61	9.25
19.00	Ream	19.00	20.58	28.50	30.88	34.20	37.60	39.10	47.50
	100 Sheets . .	3.80	4.12	5.70	6.17	6.84	7.52	7.82	9.50
19.50	Ream	19.50	21.12	29.25	31.69	35.10	38.59	40.12	48.75
	100 Sheets . .	3.90	4.22	5.85	6.34	7.02	7.72	8.02	9.75
20.00	Ream	20.00	21.66	30.00	32.50	36.00	39.58	41.16	50.00
	100 Sheets . .	4.00	4.33	6.00	6.50	7.20	7.92	8.23	10.00

Arranged by Frank Stone, Philadelphia

The "Shears Estimating Tables"

GIVING THE COST, PER 100 SHEETS OF PAPER, COSTING FROM $1.00 TO $10.75 PER REAM OF 480 SHEETS

At cost per Ream	100 Sheets cost	At cost per Ream	100 Sheets cost	At cost per Ream	100 Sheets cost	At cost per Ream	100 Sheets cost	At cost per Ream	100 Sheets cost	At cost per Ream	100 Sheets cost
$1.00	$ .21	$2.00	$ .42	$3.00	$ .63	$4.00	$ .84	$5.00	$1.05	$6.00	$1.25
1.05	.22	2.05	.43	3.05	.64	4.05	.85	5.05	1.06	6.25	1.31
1.10	.23	2.10	.44	3.10	.65	4.10	.86	5.10	1.07	6.50	1.36
1.15	.24	2.15	.45	3.15	.66	4.15	.87	5.15	1.08	6.75	1.41
1.20	.25	2.20	.46	3.20	.67	4.20	.88	5.20	1.09	7.00	1.46
1.25	.27	2.25	.47	3.25	.68	4.25	.89	5.25	1.10	7.25	1.52
1.30	.28	2.30	.48	3.30	.69	4.30	.90	5.30	1.11	7.50	1.57
1.35	.29	2.35	.49	3.35	.70	4.35	.91	5.35	1.12	7.75	1.62
1.40	.30	2.40	.50	3.40	.71	4.40	.92	5.40	1.13	8.00	1.67
1.45	.31	2.45	.52	3.45	.72	4.45	.93	5.45	1.14	8.25	1.72
1.50	.32	2.50	.53	3.50	.73	4.50	.94	5.50	1.15	8.50	1.78
1.55	.33	2.55	.54	3.55	.74	4.55	.95	5.55	1.16	8.75	1.83
1.60	.34	2.60	.55	3.60	.75	4.60	.96	5.60	1.17	9.00	1.88
1.65	.35	2.65	.56	3.65	.77	4.65	.97	5.65	1.18	9.25	1.93
1.70	.36	2.70	.57	3.70	.78	4.70	.98	5.70	1.19	9.50	1.98
1.75	.37	2.75	.58	3.75	.79	4.75	.99	5.75	1.20	9.75	2.04
1.80	.38	2.80	.59	3.80	.80	4.80	1.00	5.80	1.21	10.00	2.09
1.85	.39	2.85	.60	3.85	.81	4.85	1.02	5.85	1.22	10.25	2.14
1.90	.40	2.90	.61	3.90	.82	4.90	1.03	5.90	1.23	10.50	2.19
1.95	.41	2.95	.62	3.95	.83	4.95	1.04	5.95	1.24	10.75	2.24

Proportionate Prices on Paper per Ream

PRICE PER REAM ACCORDING TO SIZE

20x24	20x25	20x26	20x30	26x30	30x40	28x42	25x35	100 Sh. 480 to R 20x26
$1.00	$1.06	$1.09	$1.25	$1.63	$2.60	$2.45	$1.41	$0.23
1.10	1.15	1.19	1.38	1.79	2.73	2.70	2.01	.25
1.20	1.25	1.30	1.50	1.96	3.00	2.94	2.19	.28
1.30	1.36	1.41	1.63	2.12	3.25	3.19	2.37	.30
1.40	1.46	1.52	1.75	2.28	3.50	3.43	2.56	.32
1.50	1.57	1.63	1.88	2.44	3.75	3.68	2.74	.34
1.60	1.67	1.74	2.00	2.60	4.00	3.92	2.93	.37
1.70	1.77	1.84	2.13	2.77	4.25	4.17	3.10	.39
1.80	1.88	1.96	2.25	2.93	4.50	4.41	3.28	.41
1.90	1.98	2.00	2.38	3.09	4.76	4.66	3.47	.43
2.00	2.09	2.13	2.50	3.25	5.00	4.90	3.65	.45
2.10	2.19	2.28	2.63	3.41	5.25	5.15	3.83	.48
2.20	2.30	2.39	2.75	3.63	5.50	5.39	4.01	.50
2.30	2.40	2.50	2.88	3.74	5.75	5.64	4.20	.52
2.40	2.50	2.60	3.00	3.90	6.00	5.88	4.38	.54
2.50	2.61	2.71	3.13	4.07	6.25	6.13	4.56	.57
2.60	2.71	2.82	3.25	4.23	6.50	6.37	4.74	.59
2.70	2.82	2.93	3.38	4.39	6.75	6.62	4.92	.61
2.80	2.92	3.04	3.50	4.55	7.00	6.86	5.11	.64
2.90	3.02	3.15	3.63	4.71	7.25	7.11	5.29	.66
3.00	3.12	3.25	3.75	4.88	7.50	7.35	5.47	.68
3.10	3.23	3.36	3.88	5.04	7.75	7.60	5.66	.70
3.20	3.34	3.47	4.00	5.20	8.00	7.84	5.84	.73
3.30	3.44	3.58	4.13	5.36	8.25	8.09	6.02	.75
3.40	3.55	3.68	4.25	5.52	8.50	8.33	6.20	.77
3.50	3.65	3.75	4.38	5.69	8.75	8.58	6.38	.79
3.60	3.75	3.90	4.50	5.85	9.00	8.82	6.56	.82
3.70	3.86	4.01	4.63	6.01	9.25	9.07	6.75	.84
3.80	3.96	4.12	4.75	6.18	9.50	9.31	6.93	.86
3.90	4.07	4.22	4.88	6.34	9.75	9.66	7.11	.88
4.00	4.17	4.33	5.00	6.50	10.00	9.80	7.30	.90
4.10	4.27	4.44	5.13	6.66	10.25	10.06	7.48	.93
4.20	4.38	4.55	5.25	6.83	10.50	10.29	7.66	.95
4.30	4.48	4.66	5.38	6.98	10.75	10.54	7.84	.97
4.40	4.59	4.77	5.50	7.15	11.00	10.75	8.02	1.00
4.50	4.69	4.88	5.63	7.31	11.25	11.03	8.21	1.02
4.60	4.79	4.98	6.75	7.48	11.50	11.27	8.39	1.04
4.70	4.90	5.09	5.88	7.64	11.75	11.52	8.57	1.06
4.80	5.00	5.20	6.00	7.80	12.00	11.73	8.75	1.08
4.90	5.11	5.31	6.13	7.96	12.25	12.01	8.94	1.11
5.00	5.21	5.42	6.25	8.13	12.50	12.25	9.12	1.13

Arranged by F. G. Smith, Toronto, Canada

Paper Table

COST OF 1000 SQUARE INCHES

500 Shts to Ream	20x24	20x25	20x26	20x30	24x30	24x36	25x38	26x30	26x38	30x40
$1.00	00.42	00.4	00.38	00.34	00.28	00.23	00.21	00.26	00.2	00.17
1.25	00.52	00.5	00.48	00.42	00.35	00.27	00.26	00.32	00.25	00.21
1.50	00.63	00.6	00.58	00.5	00.42	00.35	00.32	00.38	00.3	00.25
1.75	00.73	00.7	00.67	00.58	00.49	00.41	00.37	00.45	00.35	00.29
2.00	00.83	00.8	00.77	00.67	00.56	00.46	00.42	00.51	00.4	00.33
2.25	00.94	00.9	00.87	00.75	00.63	00.52	00.47	00.58	00.46	00.38
2.50	01.0	01.0	00.96	00.83	00.69	00.58	00.53	00.64	00.51	00.42
2.75	01.1	01.1	01.1	00.92	00.76	00.64	00.58	00.71	00.56	00.46
3.00	01.3	01.2	01.2	01.0	00.83	00.69	00.63	00.77	00.61	00.5
3.25	01.4	01.3	01.3	01.1	00.89	00.75	00.68	00.83	00.66	00.54
3.50	01.5	01.4	01.3	01.2	00.97	00.81	00.74	00.9	00.71	00.58
3.75	01.6	01.5	01.4	01.3	01.0	00.87	00.79	00.96	00.76	00.63
4.00	01.7	01.6	01.5	01.3	01.1	00.93	00.84	01.0	00.81	00.67
4.25	01.8	01.7	01.6	01.4	01.2	00.98	00.89	01.1	00.86	00.71
4.50	01.8	01.8	01.7	01.5	01.3	01.0	00.95	01.2	00.91	00.75
4.75	02.0	01.9	01.8	01.6	01.3	01.1	01.0	01.2	00.96	00.79
5.00	02.1	02.0	01.9	01.7	01.4	01.2	01.1	01.3	01.0	00.83
5.50	02.3	02.2	02.1	01.8	01.5	01.3	01.2	01.4	01.1	00.92
6.00	02.5	02.4	02.3	02.0	01.7	01.4	01.3	01.5	01.2	01.0
6.50	02.7	02.6	02.5	02.2	01.8	01.5	01.4	01.7	01.3	01.1
7.00	02.9	02.8	02.7	02.3	01.9	01.6	01.5	01.8	01.4	01.2
7.50	03.1	03.0	02.9	02.5	02.1	01.7	01.6	01.9	01.5	01.3
8.00	03.3	03.2	03.1	02.7	02.2	01.9	01.7	02.1	01.6	01.3
8.50	03.5	03.4	03.3	02.8	02.4	02.0	01.8	02.2	01.7	01.4
9.00	03.8	03.6	03.5	03.0	02.5	02.1	01.9	02.3	01.8	01.5
9.50	04.0	03.8	03.7	03.2	02.6	02.2	02.0	02.4	01.9	01.6
10.00	04.2	04.0	03.8	03.3	02.8	02.3	02.1	02.6	02.0	01.7

Arranged by H. L. Stortz, Philadelphia

COST OF REAM—1000 INCHES—ONE SHEET

Price per Ream 20x24	Cost per 1000 Square Inches	Cost per Sheet 20x24
$2.00	.0083	.0042
2.50	.01	.0053
3.00	.013	.0063
3.50	.014	.0073
4.00	.017	.0084
4.50	.019	.0094
5.00	.021	.01
5.50	.023	.011
6.00	.025	.012
6.50	.027	.014
7.00	.029	.015

Arranged by E. J. Schwettle, Philadelphia

Cost of Various Widths of Trim Paper Given per 1000 Running Inches

Width of Strip of Trim	PRICES PER REAM OF PAPER 20x24																		
	$1.00	1.50	2.00	2.50	3.00	4.00	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00
	PRICE PER 1000 RUNNING INCHES, SHOWN IN CENTS																		
½″	.2	.3	.4	.5	.6	.9	1	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.2	5.7	6.3	6.8	7.3
⅝″	.3	.4	.5	.7	.8	1.1	1.3	2	2.6	3.3	3.9	4.6	5.3	6	6.6	7.2	8	8.6	9.2
¾″	.3	.5	.6	.8	.9	1.2	1.6	2.3	3.1	3.9	4.7	5.5	6.2	7	7.8	8.6	9.4	10.8	14.6
⅞″	.4	.6	.7	.9	1.1	1.5	1.9	2.8	3.7	4.6	5.6	6.5	7.4	8.3	9.3	10.2	11.3	12.2	12.8
1″	.4	.6	.8	1	1.3	1.7	2.1	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.3	11.2	12.3	13.3	14.3
1¼″	.5	.8	1.1	1.3	1.6	2.1	2.6	4	5.3	6.6	7.9	9.2	10.2	11.4	13.1	14.5	15.4	17.1	18.2
1½″	.6	.9	1.3	1.6	1.9	2.5	3.1	4.7	6.3	7.8	9.4	10.2	12.3	14	15.3	17.1	18.4	20.4	21.9
1¾″	.8	1.2	1.5	1.9	2.3	3.1	3.8	5.6	7.7	9.6	11.5	13.2	15.2	17.1	19.1	21.1	23	24.9	26.9
2″	.8	1.3	1.6	2.4	2.5	3.3	4.2	6.3	8.3	10.4	12.5	14.6	16.7	18.8	20.4	22.9	25	27.1	29.2

Arranged by Frank Stone, Philadelphia

Cost of Various Widths of Trim Paper Given per 1000 Running Inches

Width of Strip of Trim	PRICES PER REAM OF PAPER 20x26																	
	$1.09	1.63	2.17	2.71	3.25	4.33	5.42	8.13	10.83	13.54	16.25	18.96	21.67	24.38	27.08	29.79	32.50	35.21	37.92
	PRICE PER 1000 RUNNING INCHES, SHOWN IN CENTS																		
½″	.2	.3	.4	.5	.6	.8	1	1.6	2	2.6	3.1	3.6	4.2	4.7	5.2	5.7	6.3	6.8	7.3
⅝″	.3	.4	.5	.7	.8	1.1	1.3	2	2.6	3.3	4	4.6	5.3	5.9	6.6	7.3	7.9	8.6	9.3
¾″	.3	.5	.6	.8	1	1.3	1.6	2.4	3.2	4	4.8	5.6	6.4	7.2	8	8.8	9.6	10.4	11.2
⅞″	.4	.6	.7	.9	1.1	1.5	1.9	2.8	3.7	4.7	5.6	6.5	7.5	8.4	9.3	10.3	11.2	12.2	13.1
1″	.4	.6	.8	1	1.2	1.7	2.1	3.1	4.2	5.2	6.3	7.3	8.4	9.4	10.4	11.4	12.5	13.6	14.6
1¼″	.5	.8	1.1	1.4	1.6	2.2	2.7	4.1	5.4	6.8	8.1	9.5	10.8	12.2	13.5	14.9	16.3	17.6	19
1½″	.6	1	1.3	1.6	1.9	2.5	3.2	4.8	6.4	8	9.6	11.1	12.8	14.3	15.9	17.5	19.1	20.4	22.2
1¾″	.8	1.2	1.5	1.9	2.3	3.1	3.9	5.8	7.7	9.7	11.6	13.5	15.5	17.4	19.3	21.1	23.1	25.1	27
2″	.8	1.3	1.7	2.1	2.5	3.3	4.2	6.2	8.3	10.4	12.5	14.6	16.7	18.7	20.4	22.9	25	27	29.1
	BASIC PRICES PER REAM 20x24 EQUIVALENT TO ABOVE PRICES 20x26																		
	$1.00	1.50	2.00	2.50	3.00	4.00	5.00	7.50	10.00	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00

Arranged by Frank Stone, Philadelphia

Cost per 1000 Running Inches of 90 lb. Kraft Gummed Stay Paper at Price per lb. as Given

¾″ Wide. Average 4800″ to lb.
⅞″ Wide. Average 3600″ to lb.

Price per lb. . .	6c	6½c	7c	7½c	8c	8½c	9c	9½c	10c	10½c	11c	11½c	12c	12½c	13c
¾″ Wide	$01.3	01.4	01.5	01.6	01.7	01.8	01.9	02.0	02.1	02.2	02.3	02.4	02.5	02.6	02.7
⅞″ Wide	01.7	01.8	02.	02.1	02.3	02.4	02.5	02.6	02.8	03.0	03.1	03.2	03.4	03.5	03.7

Cost per 1000 Running Inches Combination Stay Muslin at Price per lb. as Given

¾″ Wide. Average 3600″ to lb.
⅞″ Wide. Average 2400″ to lb.

Price per lb.	15c	16c	17c	18c	19c	20c	21c	22c	23c	24c	25c	26c	28c	30c
¾″ Wide	$04.2	04.4	04.8	05.0	05.3	05.7	05.8	06.0	06.4	06.7	07.0	07.2	07.8	08.4
⅞″ Wide	06.3	06.7	07.1	07.5	08.0	08.4	08.8	09.2	09.6	10.0	10.4	11.0	11.7	13.0

Arranged by H. L. Stortz, Philadelphia

Stay Paper

90 POUND—¾″ WIDE—INCLUDING ALLOWANCE FOR NORMAL WASTE
PER 1000 BOXES OR LIDS OF FOUR CORNERS EACH

Depth of Box	@ 6c lb.	@ 7c lb.	@ 8c lb.	@ 9c lb.	@ 10c lb.	@ 11c lb.	@ 12c lb.	Lbs.
½″	$0.03	$0.04	$0.04	$0.05	$0.05	$0.06	$0.06	½
¾″	.05	.05	.06	.07	.08	.08	.09	¾
1″	.06	.06	.07	.08	.09	.10	.11	⅞
1¼″	.06	.07	.08	.09	.10	.11	.12	1
1½″	.08	.09	.10	.11	.13	.14	.15	1¼
1¾″	.09	.11	.12	.14	.15	.17	.18	1½
2″	.11	.12	.14	.16	.18	.19	.21	1¾
2¼″	.12	.14	.16	.18	.20	.22	.24	2
2½″	.12	.14	.16	.18	.20	.22	.24	2
2¾″	.14	.16	.18	.20	.23	.25	.27	2¼
3″	.15	.18	.20	.23	.25	.28	.30	2½

Arranged by Frank Stone, Philadelphia

Tables Giving Number of Strips of Given Widths ½″ to 5″ That can be Cut Out of a Sheet

WIDTH GIVEN 20 TO 32½″, WITH OFFAL OR WIDTH OF STRIPS LEFT OVER

20		22		24		25		26		28		29		30		31		32		32½	
Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over
40	...	44	...	48	...	50	...	52	...	56	...	58	...	60	...	62	...	64	...	65	...
32	...	35	⅛	38	¼	40	...	41	⅜	44	½	46	¼	48	...	49	⅜	51	⅛	52	...
26	½	29	¼	32	...	33	¼	34	½	37	¼	38	½	40	...	41	¼	42	½	43	¼
22	¾	25	⅛	27	⅜	28	½	29	⅝	32	...	33	⅛	34	¼	35	⅜	36	½	37	⅛
20	...	22	...	24	...	25	...	26	...	28	...	29	...	30	...	31	...	32	...	32	½
17	⅞	19	⅜	21	⅜	22	¼	23	⅛	24	1	25	⅞	26	¾	27	⅝	28	½	28	1
16	...	17	¾	19	¼	20	...	20	1	21	½	23	¼	24	...	24	1	25	¾	26	...
14	¾	16	...	17	⅝	18	¼	18	1¼	20	½	21	¼	21	1¼	22	¾	23	⅜	23	⅞
13	½	14	1	16	...	16	1	17	½	18	1	19	½	20	...	20	1	21	½	21	1
12	½	13	⅞	14	1¼	15	⅝	16	...	17	⅜	17	1⅜	18	¾	19	1	19	1⅛	20	...
11	¾	12	1	13	1¼	14	½	14	1½	16	...	16	1	17	¼	17	1¼	18	½	18	1
10	1¼	11	1⅜	12	1½	13	⅝	13	1⅝	14	1¼	15	⅞	16	...	16	1	17	⅛	17	⅝
10	...	11	...	12	...	12	1	13	...	14	...	14	½	15	...	15	½	16	...	16	½
9	⅞	10	¾	11	⅝	11	1⅝	12	½	13	⅜	13	1⅜	14	¼	14	1¼	15	⅜	15	⅝
8	2	9	1¾	10	1½	11	¼	11	1¼	12	1	12	2	13	¾	13	1¾	14	½	14	1
8	1	9	⅝	10	1¼	10	1¼	10	2¼	11	⅞	11	1⅞	12	1½	13	⅛	13	1⅛	13	1⅝
8	...	8	2	9	1½	10	...	10	1	11	½	11	1½	12	...	12	1	12	2	13	...
8	1⅝	8	1	9	⅜	9	1⅜	9	2⅜	10	1¾	11	⅛	11	1⅛	11	2⅛	12	½	12	1
7	¾	8	...	8	2	9	¼	9	1¼	10	1	10	1½	10	2½	11	¾	11	1¾	11	2¼
6	2¾	8	1⅞	8	1	8	2	9	⅛	9	2⅛	10	¼	10	1¼	10	2¼	11	⅜	11	⅞
6	2	7	1	8	...	8	1	8	2	9	1	9	2	10	...	10	1	10	2	10	2½
6	1¼	7	⅛	7	2⅛	8	...	8	1	8	3	9	⅞	9	1⅞	9	2⅞	10	¾	10	1¼
6	½	6	2½	7	1¼	7	2¼	8	...	8	2	8	3	9	¾	9	1¾	9	2¾	10	...
5	3⅛	6	1¾	7	⅜	7	1⅜	7	2⅜	8	1	8	2	8	3	9	⅝	9	1⅝	9	2⅛
5	2½	6	1½	6	3	7	1½	7	2½	8	...	8	1	8	2	8	3	9	½	9	1
5	1⅞	6	¼	6	2¼	6	3¼	7	⅝	7	2⅝	8	...	8	1	8	2	8	3	8	3½
5	1¼	5	3¾	6	1¼	6	2¼	6	3½	7	2¼	7	3¾	8	...	8	1	8	2	8	2½
5	⅝	5	2⅝	6	¾	6	1¾	6	2¾	7	⅞	7	1⅞	7	2⅞	8	1	8	1	8	1½
5	...	5	2	6	...	6	1	6	2	7	...	7	1	7	2	7	3	8	...	8	½
4	3½	5	1⅜	5	3⅜	6	¼	6	1¼	6	3¼	7	⅛	7	1⅛	7	2⅛	7	3⅛	7	3⅝
4	3	4	¾	5	2¾	5	3¼	6	½	6	2½	6	3½	7	¼	7	1¼	7	2¼	7	2¾
4	2½	5	⅛	5	2⅛	5	3⅛	5	4⅛	6	1¾	6	2¾	6	3¾	7	⅜	7	1⅜	7	1⅞
4	2	4	4	5	1½	5	2½	5	3½	6	1	6	2	6	3	6	4	7	½	7	1
4	1½	4	3½	5	⅞	5	1⅞	5	2⅞	6	¼	6	1¼	6	2¼	6	3¼	6	4¼	7	⅛
4	1	4	3	5	¼	5	1¼	5	2¼	5	4¼	6	1½	6	1½	6	2½	6	3½	6	4
4	½	4	2½	4	4½	5	⅝	5	1⅝	5	1⅜	5	4⅝	6	¾	6	1¾	6	2¾	6	3¼
4	...	4	2	4	4	5	...	5	1	5	3	5	4	6	...	6	1	6	2	6	2½

Arranged by F. B. Smith, Toronto, Canada

Tables Giving Number of Strips of Given Widths ½" to 5" That can be Cut Out of a Sheet

WIDTH GIVEN 33 TO 44", WITH OFFAL OR WIDTH OF STRIPS LEFT OVER

	33		34		35		36		38		39¼		40		41		42		43		44	
	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over	Out	Over
½	66	...	68	...	70	...	72	...	76	...	78	¼	80	...	82	...	84	...	86	...	88	...
⅝	52	½	54	¼	56	...	57	⅜	60	½	62	½	64	...	65	⅜	67	⅛	68	½	70	¼
¾	44	...	45	¼	46	½	48	...	50	½	52	¼	53	¼	54	½	56	...	57	¼	58	½
⅞	37	⅝	38	¾	40	...	41	½	43	⅜	44	¾	45	⅝	46	¾	48	...	49	⅛	50	¼
1	33	...	34	...	35	...	36	...	38	...	39	¼	40	...	41	...	42	...	43	...	44	...
1⅛	29	⅛	30	¼	35	⅛	32	...	33	⅞	34	1	35	⅝	36	½	37	⅜	38	¼	39	⅛
1¼	26	½	27	¼	28	...	28	1	30	½	31	½	32	...	32	1	33	¾	34	½	35	¼
1⅜	24	...	24	1	25	⅝	26	¼	27	⅞	28	¾	29	½	29	1⅛	30	¾	31	⅜	32	...
1½	22	...	22	1	23	½	24	...	25	½	26	¼	26	1	27	½	28	...	28	1	29	½
1⅝	20	½	20	1½	21	⅞	22	¼	23	⅝	24	¼	24	1	25	⅝	25	1⅛	26	¾	27	⅛
1¾	18	1½	19	¾	20	...	20	1	21	1¼	22	¾	22	1½	23	¾	24	...	24	1	25	¼
1⅞	17	1⅛	18	¼	18	1¼	19	⅜	20	½	20	1¾	21	⅝	21	1⅝	22	¾	22	1¾	23	⅞
2	16	1	17	...	17	1	18	...	19	...	19	1¼	20	...	20	1	21	...	21	1	22	...
2⅛	15	1⅛	16	...	16	1	16	2	17	1⅞	18	1	19	1¾	19	5⅛	19	1⅝	20	½	20	1½
2¼	14	1½	15	¼	15	1½	16	...	15	2	17	1	17	1¾	18	½	18	1½	19	¼	19	1¼
2⅜	13	2⅛	14	¾	14	1¾	15	⅜	16	...	16	1¼	16	2	18	⅝	17	1⅝	18	1¼	18	2¼
2½	13	½	13	1½	14	...	14	1	15	½	15	1¾	16	...	16	1	16	2	17	½	17	1½
2⅝	12	1½	12	2½	13	⅞	13	1⅞	14	1¼	14	2½	15	⅝	15	1⅝	16	...	16	1	16	2
2¾	12	...	12	1	12	2	13	¼	13	2¼	14	¾	14	1½	14	2½	15	¾	15	1¾	16	...
2⅞	11	1⅜	11	2⅜	12	½	12	1½	13	⅞	13	1⅞	13	2⅝	14	¾	14	1¾	14	2¾	15	⅞
3	11	...	11	1	11	2	12	...	12	2	13	¼	13	1	12	2	14	...	14	1	14	2
3⅛	10	1¾	10	2¾	11	⅝	11	1⅝	12	½	12	1¾	12	2½	13	⅜	13	1⅜	13	2⅜	14	¼
3¼	10	½	10	1½	10	2½	11	¼	11	2¼	12	¼	12	1	12	2	12	3	13	¾	13	1¾
3⅜	9	2⅝	10	¼	10	1¼	10	2¼	11	⅞	11	2½	11	2⅞	12	½	12	1½	12	2½	13	⅛
3½	9	1½	9	2½	10	...	10	1	10	3	11	¾	11	1½	11	2½	12	...	12	1	12	2
3⅝	9	⅜	9	1⅜	9	2⅜	9	3⅜	10	1¾	10	3	11	⅛	11	1⅛	11	2⅛	11	3⅛	12	½
3¾	8	3	9	¼	9	1⅛	9	2¼	10	½	10	1¾	10	2½	10	3½	11	¾	11	1¾	11	2¾
3⅞	8	2	8	3	9	⅛	9	1⅛	10	2½	10	½	10	1¼	10	2¼	10	3¼	11	⅜	11	1⅜
4	8	1	8	2	8	3	9	...	9	2	9	3¾	10	...	10	1	10	2	10	3	11	...
4⅛	8	...	8	1	8	2	8	3	9	⅞	9	2½	9	2⅞	9	3⅞	10	¾	10	1¾	10	2¾
4¼	7	3¼	8	...	8	1	8	2	8	4	9	1	9	1¾	9	2¾	9	3¾	10	½	10	1½
4⅜	7	2⅜	7	3⅜	8	...	8	1	8	3	8	4¼	9	⅝	9	1⅝	9	2⅝	9	3⅝	10	¼
4½	7	1½	7	2½	7	3½	8	...	8	2	8	3¼	8	4	9	½	9	1½	9	2½	9	3½
4⅝	7	⅝	7	1⅝	7	2⅝	7	3⅝	8	1	8	2¼	8	3	9	⅜	9	1⅜	9	2⅜	9	3⅜
4¾	6	4½	7	¾	7	1¾	7	2¾	8	...	8	1¼	8	2	8	3	8	4	9	¼	9	1¼
4⅞	6	3¾	6	4¾	7	⅞	7	1⅞	7	3⅞	8	¼	8	1	8	2	8	3	8	4	9	¼
5	6	3	6	4	7	...	7	1	7	3	7	4¼	8	...	8	1	8	2	8	3	8	4

Arranged by F. B. Smith, Toronto, Canada

Cost of 1000 Running Inches Strip Paper, width 5/8" to 2"

BASIS 24"x36". 25 POUND, 480 SHEETS TO REAM PRICE PER POUND AS GIVEN IN CENTS

Per Pound	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	2"
5c	.2	.23	.26	.3	.34	.4	.46	.52	.6
5 1/2c	.21	.25	.29	.34	.38	.42	.5	.58	.68
6c	.22	.27	.32	.36	.4	.44	.54	.64	.72
6 1/2c	.25	.3	.34	.39	.44	.5	.6	.68	.78
7c	.26	.31	.36	.42	.47	.52	.62	.72	.84
7 1/2c	.28	.34	.39	.45	.51	.56	.68	.78	.9
8c	.3	.36	.43	.49	.55	.6	.72	.86	.98
8 1/2c	.32	.38	.45	.51	.57	.64	.76	.9	1.0
9c	.34	.41	.48	.54	.61	.68	.82	.96	1.1
9 1/2c	.36	.43	.51	.58	.65	.72	.86	1.0	1.2
10c	.38	.45	.53	.6	.68	.76	.9	1.1	1.2

Arranged by H. L. Stortz, Philadelphia

Cost of 1000 Running Inches Strip Paper, width 5/8" to 2"

BASIS 24"x36". 30 POUND, 480 SHEETS TO REAM. PRICE PER POUND AS GIVEN IN CENTS

Per Pound	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	2"
5c	.22	.27	.31	.36	.4	.44	.54	.62	.72
5 1/2c	.25	.3	.34	.39	.44	.5	.6	.68	.78
6c	.28	.33	.39	.44	.5	.56	.66	.78	.88
6 1/2c	.3	.36	.42	.47	.53	.6	.72	.84	.94
7c	.32	.38	.45	.51	.57	.64	.76	.9	1.0
7 1/2c	.34	.41	.48	.54	.61	.68	.82	.96	1.1
8c	.36	.43	.51	.58	.65	.72	.86	1.0	1.2
8 1/2c	.38	.46	.54	.61	.69	.76	.92	1.1	1.2
9c	.41	.49	.57	.65	.73	.82	.98	1.1	1.3
9 1/2c	.43	.51	.6	.68	.77	.86	1.0	1.2	1.4
10c	.46	.55	.64	.73	.82	.92	1.1	1.3	1.5

Arranged by H. L. Stortz, Philadelphia

Cost of 1000 Running Inches Strip Paper, width 5/8" to 2"

BASIS 24"x36". 35 POUND, 480 SHEETS TO REAM. PRICE PER POUND AS GIVEN IN CENTS

Per Pound	5/8"	3/4"	7/8"	1"	1 1/8"	1 1/4"	1 1/2"	1 3/4"	2"
5c	.26	.31	.36	.42	.47	.52	.62	.72	.84
5½c	.29	.35	.41	.46	.52	.58	.7	.82	.92
6c	.32	.38	.45	.51	.57	.64	.76	.9	1.02
6½c	.35	.42	.49	.56	.62	.7	.84	.98	1.12
7c	.37	.44	.52	.59	.66	.74	.88	1.04	1.18
7½c	.4	.48	.56	.64	.72	.8	.96	1.12	1.28
8c	.42	.5	.59	.67	.76	.84	1.00	1.18	1.34
8½c	.45	.54	.63	.72	.81	.9	1.08	1.26	1.44
9c	.48	.57	.67	.76	.86	.96	1.14	1.34	1.52
9½c	.5	.6	.7	.8	.9	1.0	1.2	1.4	1.6
10c	.53	.63	.74	.84	.95	1.06	1.26	1.48	1.68

Arranged by H. L. Stortz, Philadelphia

Cost of 1000 Running Inches Strip Muslin at Varying Widths

BASED ON PRICE PER 1000 YARDS, 1" WIDE
PRICE GIVEN IN CENTS

Price per 1000 Yards 1" Wide	5/8"	3/4"	7/8"	1"	1 1/8"
$2.00	3.5	4.2	5.0	5.6	6.3
2.50	4.3	5.1	6.1	7.0	7.9
3.00	5.3	6.3	7.4	8.4	9.4
3.50	6.1	7.4	8.6	9.8	11.0
4.00	6.7	8.1	9.6	11.0	12.3
4.50	8.1	9.3	11.3	13.0	14.6
5.00	8.6	10.2	12.2	14.0	15.7

Arranged by H. L. Stortz, Philadelphia

COST OF 1000 RUNNING INCHES MUSLIN OR PIECE GOODS CUT FROM 1 YARD OF MATERIAL 24″ WIDE AT PRICE PER YARD GIVEN AND WIDTH OF STRIP FROM 5/8″ TO 2″ IN CENTS

24″	5/8″	3/4″	7/8″	1″	1 1/8″	1 1/4″	1 1/2″	1 3/4″	2″
Per Yard									
5c	3.6	4.3	5.0	5.8	6.5	7.2	8.6	10.0	12.0
5½c	4.0	4.8	5.6	6.4	7.2	8.0	9.6	11.2	12.8
6c	4.4	5.2	6.1	7.0	7.8	8.8	10.4	12.2	14.0
6½c	4.8	5.6	6.9	7.5	8.5	9.6	11.2	13.8	15.0
7c	5.1	6.1	7.1	8.1	9.1	10.2	12.2	14.2	16.2
7½c	5.4	6.5	7.6	8.6	9.7	10.8	13.0	15.2	17.1
8c	5.8	7.0	8.1	9.3	10.6	11.6	14.0	16.2	18.6
8½c	6.2	7.4	8.6	9.8	11.1	12.3	14.8	17.2	19.6
9c	6.5	7.8	9.1	10.4	11.7	13.0	15.6	18.2	20.8
9½c	6.9	8.2	9.6	10.7	12.3	13.8	16.4	19.2	21.4
10c	7.2	8.6	10.0	11.5	13.0	14.4	17.2	20.0	23.0

Arranged by H. L. Stortz, Philadelphia

COST OF 1000 RUNNING INCHES MUSLIN OR PIECE GOODS CUT FROM 1 YARD OF MATERIAL 30″ WIDE AT PRICE PER YARD GIVEN AND WIDTH OF STRIP FROM 5/8″ TO 2″ IN CENTS

30″	5/8″	3/4″	7/8″	1″	1 1/8″	1 1/4″	1 1/2″	1 3/4″	2″
Per Yard									
5c	2.9	3.5	4.1	4.6	5.2	5.8	7.0	8.2	9.2
5½c	3.2	3.8	4.5	5.1	5.7	6.4	7.6	9.0	10.2
6c	3.5	4.2	4.9	5.6	6.2	7.0	8.4	9.8	11.2
6½c	3.8	4.5	5.3	6.0	6.8	7.6	9.0	10.6	12.0
7c	4.1	4.9	5.7	6.5	7.3	8.2	9.8	11.4	13.0
7½c	4.3	5.2	6.1	6.9	7.8	8.6	10.4	12.2	13.8
8c	4.6	5.6	6.5	7.4	8.3	9.2	11.2	13.0	14.8
8½c	4.9	5.9	6.9	7.9	8.9	9.8	11.8	13.8	15.8
9c	5.2	6.3	7.3	8.3	9.4	10.4	12.6	14.6	16.6
9½c	5.5	6.6	7.7	8.8	9.9	11.0	13.2	15.4	17.6
10c	5.8	6.9	8.1	9.3	10.1	11.6	13.8	16.2	18.6

Arranged by H. L. Stortz, Philadelphia

COST OF 1000 RUNNING INCHES MUSLIN OR PIECE GOODS CUT FROM 1 YARD OF MATERIAL 36″ WIDE AT PRICE PER YARD GIVEN AND WIDTH OF STRIP FROM ⅝″ TO 2″ IN CENTS

36″	⅝″	¾″	⅞″	1″	1⅛″	1¼″	1½″	1¾″	2″
Per Yard									
5c	2.4	2.9	3.4	3.9	4.3	4.8	5.8	6.8	7.8
5½c	2.7	3.2	3.7	4.2	4.8	5.4	6.4	7.4	8.4
6c	2.9	3.5	4.0	4.6	5.2	5.8	7.0	8.0	9.2
6½c	3.1	3.8	4.4	5.0	5.6	6.2	7.6	8.8	10.0
7c	3.4	4.1	4.7	5.4	6.1	6.8	8.2	9.4	10.8
7½c	3.6	4.3	5.1	5.8	6.5	7.2	8.6	10.2	11.6
8c	3.9	4.6	5.4	6.2	6.9	7.8	9.2	10.8	12.4
8½c	4.1	4.9	5.7	6.6	7.4	8.2	9.8	11.4	13.2
9c	4.3	5.2	6.1	6.9	7.8	8.6	10.4	12.2	13.8
9½c	4.6	5.5	6.4	7.3	8.2	9.2	11.0	12.8	14.6
10c	4.8	5.8	6.8	7.7	8.7	9.6	11.6	13.6	15.4

Arranged by H. L. Stortz, Philadelphia

Box Twine Table

COST PER 1000 RUNNING INCHES AT PRICE PER POUND AS GIVEN IN CENTS

Price per lb.	10c	11c	12c	13c	14c	15c	16c	17c	18c	19c	20c	21c	22c	23c	24c	25c
2-Ply Box 4700″ to lb.	2.1	2.3	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.3	4.5	4.7	4.9	5.1	5.3
3-Ply Box 3100″ to lb.	3.2	3.5	3.9	4.2	4.5	4.8	5.2	5.5	5.8	6.1	6.5	6.8	7.1	7.4	7.7	8.1
3-Ply Jute 8600″ to lb.	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	2.1	2.2	2.3	2.4	2.6	2.7	2.8	2.9
4-Ply Jute 6500″ to lb.	1.5	1.7	1.8	2.0	2.2	2.3	2.5	2.6	2.7	2.9	3.1	3.2	3.4	3.5	3.7	3.8
5-Ply Jute 5200″ to lb.	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	3.8	4.0	4.2	4.4	4.6	4.8
6-Ply Jute 4500″ to lb.	2.2	2.4	2.7	2.9	3.1	3.3	3.5	3.8	4.0	4.2	4.4	4.7	4.9	5.1	5.3	5.6

Arranged by H. L. Stortz, Philadelphia

COST PER 1000 RUNNING INCHES OF METAL EDGE AT PRICE PER 100 FEET AS GIVEN IN CENTS

Price per 100 Ft.	28c	30c	32½c	35c	36c
Price per 1000 Ft.	23.4	25.0	28.0	29.2	30.0

Arranged by H. L. Stortz, Philadelphia

COST PER 1000 RUNNING INCHES OF METAL STITCH WIRE AT PRICE PER POUND AS GIVEN IN CENTS

Price per lb.	10c	11c	12c	13c	14c	15c	16c	17c	18c	20c
No. 8x104—363 feet (4356″) to lb.	2.3	2.5	2.8	3.0	3.2	3.4	3.7	3.9	4.1	4.6
No. 11x104—256 feet (3072″) to lb.	3.3	3.6	3.9	4.2	4.6	4.9	5.2	5.5	5.9	6.6
No. 14x104—200 feet (2400″) to lb.	4.2	4.6	5.0	5.4	5.8	6.3	6.7	7.1	7.5	8.4
No. 20x25—416 feet (4992″) to lb.	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	4.0
No. 23x 30—714 feet (8568″) to lb.	1.2	1.3	1.4	1.5	1.6	1.8	1.9	2.0	2.1	2.4

Arranged by H. L. Stortz, Philadelphia

Glue and Gum

The result of the tabulation of the data gathered by the committee on the subject of Glue and Gum showed a very wide variation. This was to be expected in view of the large variety of work done and conditions prevailing. The difference in cost per pound of glue or gum and the difference in quality of the same; all these conditions contributed to make a large variation in results.

GUM—The committee found that in the use of gum, figuring the cost per 100 sheets paper 20 x 24, the tabulation showed a minimum cost of 8 cents per 100 sheets and a maximum of $1.00 per 100 sheets 20 x 24. Owing to the large variation in data it was therefore considered advisable to use the data showing the surface which 1 pound of dry glue or gum would cover. The result of this tabulation showed that 1 pound of dry gum would be used to cover a minimum of 18,000 square inches to a maximum of 60,000 square inches of paper. From this data the committee established an average of 24 oz. of dry gum to 100 sheets of paper 20 x 24, or 7½ pounds of dry gum to 1 ream of 500 sheets paper 20 x 24.

GLUE—The same wide difference in the data received on glue was shown. The tabulation showed on the basis of cost per 100 sheets of paper 20 x 24 minimum of 10 cents per 100 sheets and a maximum of $1.25 per 100 sheets.

The data showing surface covered by 1 pound of dry glue showed a minimum of 16,000 square inches and a maximum of 60,000 square inches. From this data the committee established an average of 24 oz. dry glue to 100 sheets of paper, basis 20 x 24 or 7½ pounds of dry glue to a ream of 500 sheets of paper 20 x 24.

The cost committee therefore recommends that these figures be used as an average in calculating the surface covered by gum and glue. From this it will be seen that in calculating the cost of glue and gum, multiply the cost per pound of material by 7½ to get the cost of adhesive to cover 1 ream of 500 sheets of paper 20 x 24.

For example: If you are paying 20 cents per pound for glue the cost would be 7½ x 20 or $1.50 per ream 20 x 24. These figures are given merely as an average obtained by tabulation of data collected.

In estimating—The conditions prevailing in the work being done should be considered, as the amount of gum or glue will vary, depending on the quality of glue or gum, on the nature of the work, quality of paper, board, and the skill of the operator.

JOINT COST COMMITTEE,
National Federation Paper Box Manufacturers Association.
H. L. STORTZ, Secretary.

Waste and Spoilage

The "Questionnaire" sent by the committee to the subscribers on the subject of waste and spoilage resulted in replies showing a wide difference on the data.

The tabulation of the data collected showed following results:

Where an average per cent on all materials was given, the minimum shown was 3 per cent, the maximum 15 per cent.

Where board was itemized the minimum was 2%, maximum 5%.

Where paper was itemized the minimum was 3%, maximum 10%.

Where operations were specified the result was as follows:

Stayers, 1 to 3 per cent.
Enders, 1 to 10 per cent.
Strip Cover Machine, 7 to 12 per cent.
Stokes & Smith Machine, 5 to 15 per cent.
Toppers, 7 to 12 per cent.

Where quantities were specified the data was as follows:

Lots of 100 or less, 10 to 25 per cent.
Lots of 1000 or less, 5 to 10 per cent.
Lots of 5000 or over, 2 to 5 per cent.

The subject of the committee in gathering this data was to endeavor to establish an average percentage that should be added to all calculation of materials to cover waste and spoilage.

The committee after due consideration of the entire subject, considered it inadvisable to attempt in its recommendations to divide the waste and spoilage with reference to class of materials and product, as this was a matter that would necessarily have to be considered by the estimator. It should be evident to the practical box manufacturer that in estimating the conditions prevailing in the work, should be considered.

However, the committee *recommends that a minimum of 5 per cent should be established* as an average to be added to all calculations of materials to cover the item of waste and spoilage.

JOINT COST COMMITTEE,
National Federation Paper Box Manufacturers Association.
H. L. Stortz, Secretary.

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